AMERICAN JOURNAL OF ORTHODONTICS

OFFICIAL PUBLICATION OF
THE AMERICAN ASSCCIATION OF ORTHODONTISTS,
ITS COMPONENT SOCIETIES, AND
THE AMERICAN BOARD OF ORTHODONTICS

PUBLISHED BY THE C. V. MOSBY COMPANY, ST. LOUIS 3, U. S. A.

TABLE OF CONTENTS ON PAGE 2

Vol. 35 MARCH, 1949 No. 3

Vol. 35, No. 3, March, 1949. American Journal of Orthodontics is published by The C. V. Mosby Company, 3207 Washington Blvd., St. Louis 3, Mo. Subscription Price: United States, its Possessions, Pan-American Countries, $10.00; Canada and Foreign, $11.00. Entered as Second-class Matter January 14, 1915, at the Post Office at St. Louis, Missouri, under the Act of March 3, 1879. Printed in the U. S. A.


ORALIUM
BAND MATERIAL
FAST BECOMING STANDARD
FOR ECONOMY BANDS
PURE PLATINUM
ORALIUM
CENTRE
PURE PLATINUM
ORALIUM BAND MATERIAL
ORALIUM is the inexpensive band material. We take a large half inch thick bar of the very light weight Oralium casting gold and weld a sheet of pure platinum on both sides of this, then roll it out into all required gauges and widths of strips and ready made bands as illustrated.
The three sheets of metal welded together have extreme toughness and non-tearing qualities with the proper malleability. If you grind through the pure platinum surface you expose only a very good precious metal alloy.
Ten per cent iridium-platinum has always been the recognized standard of band materials but because of its high cost and the scarcity of iridium we are advocating our
PLATINALOY, the 100% gold and platinum metals band material which has all the qualifications of 10% iridium-platinum;
CONTURO, which is a little cheaper but popular with some because of its extreme toughness and the ease with which it can be unsoldered. Sold in strip form only.
We believe it is to our best mutual interests to supply your needs through your local dealers if you care to send us his name with your order.
NO. 1
NO. 2
NO. 3
NO. 4
JOHNSON ORALIUM
LOOP MOLAR BANDS
GUMWOOD
BOX
PLATINALOY OR ORALIUM—48 SIZES—NOS. 1 TO 12 EXTREME TAPER, 13 TO 24, SLIGHT TAPER AND 25 TO 48 STRAIGHT.
JOHNSON ORALIUM LOOP BANDS—4 SIZES ALL YOU NEED. ORDERS FOR 100 IN CLOTH COVERED BOX.
BAKER & CO., INC.
113 Astor St., Newark 5, N. J.
30 CHURCH ST.
NEW YORK 7
55 E. WASHINGTON ST.
CHICAGO 2
760 MARKET ST.
SAN FRANCISCO 2

CONTENTS FOR MARCH, 1949

American Journal of Orthodontics

Original Articles

Orthodontic Abstracts and Reviews

News and Notes

Officers of Orthodontic Societies

The University of Detroit
SCHOOL OF DENTISTRY

Announces

A Course for Orthodontists in Clinical and Technical Manipulation of the Edgewise Arch Mechanism in Accordance with the Teachings of Dr. Charles H. Tweed.

Under the Direction of Dr. Samuel J. Lewis.

July 11 to July 23, 1949

Class will be limited to 30 members.

Write for application blanks to— Dr. Rene Rochon, Dean, 630 E. Jefferson Ave., Detroit 26, Mich.

Orthodontist veteran, university certificate in Orthodontics, seeks association with another orthodontist, preferably in Pennsylvania.

Address: American Journal of Orthodontics, Box AB, 3207 Washington Blvd., St. Louis 3, Mo.

Former Naval Dental Officer will complete $2\frac{1}{2}$ years of graduate orthodontic training at the University of Michigan in June, 1949. He is seeking a suitable practice location wherever best opportunities are present and would consider an association. Address: American Journal of Orthodontics, Box BM, 3207 Washington Blvd., St. Louis 3, Mo.

ANNOUNCING THE REVOLUTIONARY

New...

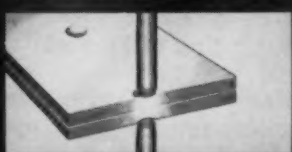
Unimatic

SPOTWELDER

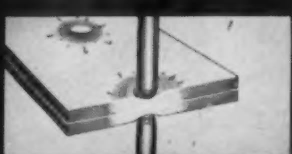
Check These Features

- Clean-finished weld
- Uniform performance
- Auto-adjustment
- Time-saving
- Greater weld strength

New Unimatic Weld
Shows no evidence of burning, discoloration or spattering — only a very slight depression.



Old Type Weld
Definite signs of burning, discoloration, spattering and heat distortion—deeply indented.



Note: Comparative sizes greatly exaggerated for diagrammatic purposes.

Unimatic introduces *Pushbutton Spotwelding* . . . press *one* button . . . the *Unimatic* welder does the rest! Yes, this unit actually does your welding thinking for you—no rheostats, no auxiliary timer, no burning, no weld failures, no *guesswork*—merely push the button . . . Unimatic does it all!

Unitek engineers, after intensive research, have developed this revolutionary feature by incorporating in the *Unimatic* welder a sensitive electronic circuit of high selectivity. When actuated by a "touch of the button" the electronic brain instantly determines the amount of resistance heat required to homogeneously bond materials through a range of thicknesses.

Unparalleled for its efficiency and time-saving advantages, the *Unimatic* welder has been designed to meet the exacting requirements of the Orthodontist. Uniform and dependable performance insures a stronger weld, reducing breakage . . . a clean, finished weld, eliminating polishing.

The *Unimatic* unit is sturdily built and compactly designed to occupy a minimum of space. Leads and terminals are provided for evenly-controlled annealing. Platinum gray hammertone finish with chrome trim makes the *Unimatic* a handsome addition for office or laboratory.

Complete Unit — Price $88.00
F.O.B. Pasadena, California

Write TODAY for the complete Unitek catalog!

Unitek
CORPORATION

697 N. LAKE AVE. • PASADENA 6, CALIF.

There is an apparent discrepanc

The pages are either missing or

The filming is recorded as the b

ncy at this point.

or the pagination is incorrect.

book is found in the collections.

American Journal
of
ORTHODONTICS

Vol. 35 March, 1949 No. 3

Original Articles

RHINOLOGIC EXPERIENCES TO AID THE ORTHODONTIST

Harry Neivert, M.D., D.Sc., New York, N. Y.

I AM grateful for the opportunity to appear before your society to tell you as orthodontists how we rhinologists can be of service to you. Our respective fields are in such close proximity that it behooves both groups to learn more of what each has to offer the other. During many years of teaching in the Orthodontic Department at Columbia University, and at various national and regional meetings, I have attempted to bring together many theories and facts which might be of benefit to the orthodontist. Some of these can be repeated here for further discussion, and I hope to show some advances in the field of rhinology which will be of particular interest.

Very often children are brought to the rhinologist because of mouth breathing and other afflictions in the nose and throat. Most of these children have some degree of malocclusion or other deformity of face or jaws. We see these children, as a rule, many years before you do and we can help by eliminating all recognizable and amenable causes.

I like to quote McCoy: "Orthodontics is a study of dental and oral development. It seeks to determine the factors which control growth processes to the end that a normal functional and anatomical relationship of these parts may be realized, and aims to learn the influences necessary to maintain such conditions when once established." The last part is *so* important and that is where the rhinologist comes in. "Orthodontics as a part of the healing art, has been evolved as the result of necessity, for the prevalence of dental and oral anomalies among the civilized people of the world is existent to an appalling degree. The most casual observation will confirm this fact if a study is made of the faces and mouths of those with whom we have daily contact. In many instances the condition may be but trivial, but a close observation will reveal the fact that hundreds or even thousands of people are afflicted with oral deformities which have not only seriously impaired the functional efficiency of the masticatory apparatus, but have stamped the faces and mouths of those afflicted with the indelible mark of deformity."

Presented before the Southern Society of Orthodontists, Memphis, Tenn., Oct. 11, 1948.

Again in discussing the aims and benefits of orthodontic treatment to the individual he says: "We should not consider them as being limited to the restoration of the denture to its normal functional relations for the mastication of food, for laudable as is this objective, this complex organ must fulfill still other functions of equal importance. In speech, in respiration and, in fact, in the general plan of growth and development of the face it is an important factor, for it is surrounded and supported by tissues and structures whose development is dependent, to some degree, upon the stimuli which come from its normal functioning. It constitutes a central harmonizing agency whose function, if interfered with has its effect upon the surrounding structures, manifest as maldevelopments, the extent and severity of which are often in direct proportion to the impairment of its function."

The psychological angle is extremely important in the young. Sooner or later every child begins to pay attention to his or her appearance and compares it with his friends. He begins to react favorably or otherwise in proportion to the degree of abnormality and to the extent of his sensitivity. It is during the early years that life patterns are developed, and it behooves every practitioner to advise parents of his patients what help can be gotten from the rhinologist and other medical consultants.

You are all familiar with the studies of Todd and Broadbent who, I believe, have conclusively proved that any persistent obstruction to normal nasal respiration interferes with the proper development of the occlusive elements, the teeth, the alveolar arches, and the muscles. To these I wish to add also the improper balancing of the rate and type of growth of the mandible, maxilla, external nose, and the muscles about them. A. LeRoy Johnson says: "This assemblage of structures, varying in developmental nature is organized in anticipation of a definite function to harmonize them. The teeth are surrounded and supported by tissues whose development depends upon the stimuli of function. While the development of tooth forms, under normal conditions, is not known to be influenced in the least by function, hence, from the physiological character of the oral tissues, the force to harmonize them is that which will adapt the functional structure to the requirement of the tooth forms, namely, the specific function of mastication." Mouth breathers do not masticate properly; therefore, the various structures do not grow harmoniously and varied strains and stresses on component parts cause irregularity of the facial features.

I am extremely interested in the statement by McCoy concerning a type of anomaly in which the lower teeth are mesial to normal and the mandible protrudes. He is convinced that in some cases this is caused by muscular response to enlarged and infected tonsils. These irritate the posterior part of the mandible which is unconsciously moved forward and subsequently held there by the involuntary and reflex action of the adjacent muscles and the tongue. This result brings increased space around the inflamed tonsil and relief from pressure. The tongue is also projected forward and, in order to keep it in the mouth, the mandible must be projected farther and the muscles continue to pull until the bones are stretched and remain in a difficult malposition.

What are some of the factors we must bear in mind which influence nasal respiration? Remember, please, that this is a reflex act and it is normal to breathe through the nose, but when obstruction exists the child develops new reflexes which will persist even after the original cause has been removed. This is well known to our utter chagrin. It may take years of conscious effort to re-establish the normal nose-lung and respiratory reflex, and it must be conscious and determined. Only by re-establishing new reflex pathways to the medulla will it be possible to overcome the long-existing unnatural reflex which to the patient is the only natural way he knows. This same problem exists with thumb-sucking which is at first a conscious, pleasure-provoking act, and then becomes a conditioned reflex which no amount of scolding can correct.

Starting at the nostril, let us name the factors to be studied as possible causes of respiratory difficulty. Looking at the base of the nose, we may find the nostrils too large or too small. They may be of unequal size or may deviate from the medial line. The tip of the nose may hang too low, thus changing the plane of the nostrils and the direction of the air currents which create changes in the mucous membranes of the nose and sinuses. The same may be said about the large hump nose seen in adults. Deviations of the nasal septum, deformities of the turbinates, swelling of the mucous membranes due to allergy or chronic sinusitis, polyps, especially so-called choanal polyps which hang down in the nasopharynx, and adenoids all cause persistent nasal blockage. Then we must remember the too roomy nose, either congenital or due to atrophic changes which interfere with the respiratory reflex because the air going into the nose does not cause enough stimulation of the nerves to initiate nasal breathing and the patient resorts to mouth breathing automatically. Facial asymmetry due to pressure habits will cause twisted nose and obstruction. All these conditions are developmental or environmental, but heredity must play some part in aggravating existing pathology. I mention cleft palate and cleft lip also only to emphasize that the oral surgeon, in whose province these conditions fall, must be part of the team who can help correct conditions in his domain. The educated orthodontist will know just whom he will need to supplement or aid in getting the best and most permanent results.

The teeth, as well as the sinuses and nasopharynx, have definite relationships to the geniculate ganglion and indirectly act upon the tympanic nerve plexus (via the greater and lesser superficial petrosal nerves) situated in the middle ear and on that portion of the wall of the cochlea which usually becomes sclerosed in the form of deafness known as otosclerosis.

In certain types of malocclusion in which the mandible is not in normal relationship to the superior maxilla, excessive condyloid pressure may irritate the chorda tympani nerve, resulting in tinnitus or/and vertigo. This may also occur in low-grade pulpitis. I mention these nerve connections merely to emphasize the complexity of the pathways along which impulses from malocclusion and other dental abnormalities may cause symptoms in other parts.

What can we do for the anatomical obstructions? Deflections of the lower half of the nose due to postural or traumatic causes, and deformities of the nasal

septum such as curvatures, thickening due to exostoses, old fractures, etc., are corrected by the conventional submucous resection of the cartilaginous and/or bony parts of the septum. This applies to children who have attained fairly full growth of the nasal structures. This may be as early as the age of 15 in some. In most cases, however, a plastic reconstruction of the septum sacrificing but very little of the cartilage or bone can be done as early as 8 years.

The septum operation has been in great disrepute with the public as well as with many physicians because in many cases the complaint for which the patient sought relief was still present after the operation. The only reason the patient consented to undergo surgery was obstruction to breathing. The careless rhinologist, or shall we be charitable and say the "busy" rhinologist, hurriedly looks into the nose, sees some septal deformity which may or may not be the real cause of the trouble, and proceeds to advise an operation. This advice may be correct if the deviation is the sole cause of the difficulty in breathing. The result, of course, would depend on the proficiency of the surgeon. The septum operation can be one of the most difficult in the field of rhinology. We are dealing with two layers of soft tissue, the mucous membranes, between which lies a layer of cartilage and bone. If the deformity is marked, the cartilage and bone will have sharp, angulated projections covered by thin, often scarred, devitalized membrane which is extremely difficult to elevate. The trick is to remove all the bony and cartilaginous deformity without perforating the mucoperichondrium or mucoperiosteum. Then there is the problem of how high up under the nasal dorsum one dares go without chancing a dorsal sinking or saddle nose. Some men believe that the septum is not needed for support in the normal nose. The bony dorsum, being made up of the union of both nasal bones, forms an arch which needs no support. The upper lateral cartilages, really part of the septum, form an arch which sits on the septum, all three elements being completely fused into one piece. Infection or excessive contraction of the membranes after the cartilage has been removed will cause a sinking of the lower half of the nasal dorsum.

Where the deformity of the septum is due to irregularity in the region of the columella, then a problem presents which must be handled by the rhinologist trained in rhinoplasty. The same holds for deviations of the lower lateral cartilages.

Since the size of the nostrils, whether too large or too small, has a marked influence on the respiratory tract, the rhinologist must be prepared to remedy this by appropriate plastic procedures. The columella or presenting end of the septum is easily remedied by removing a wedge through an incision in the nasal vestibule. This part of the septum, if too long, may be shortened, and the lip made longer, giving a much more pleasing appearance.

The nasal passages may be narrowed by weakness of the lower lateral walls. At each inspiration the lateral walls are drawn into contact with the septum, practically closing off the airway. This condition is frequently seen in mouth breathers with long-standing obstruction due to adenoids. Since the nasal passages are not used, the muscles about the tip remain rudimentary and the nasal

vestibule is consequently narrowed. This condition can be remedied by inserting slivers of cartilage into the walls, which prevent much of the collapse. Most of these patients also have a thick columella, which can be reduced at the same time, thus enlarging the nares. In other cases, we can shorten the lateral walls by excising and undermining a small area in the nasal vestibule. Some years ago I devised a technique whereby I brought down a flap from the upper part of the vestibule and sewed it into an incision at the lateral angle of the nostril.

The large nostrils are simple to correct. Excisions or wedges of varying sizes are removed from the floor of the vestibule and the edges sutured to form a proper oval aperture. By narrowing the opening, the air current is not dissipated in the vestibule and the stimulus from it creates the reflex for normal nasal breathing. On the contrary, if the nares are too small, the air goes in at too rapid a pace and dries the mucous membrane. This results in eventual change or metaplasia of the membrane from ciliated cylindrical type with glands: two important and necessary elements. Examination at this stage shows crusts, dry, glistening areas, subject to frequent nosebleeds and further narrowing because of thickening of the cartilage from protracted irritation.

What might be the causes of unsatisfactory results after the submucous resection of the nasal septum, outside of the septum itself? The patient may be allergic and therefore have constant blockage. Very often the inferior turbinates are hypertrophic or hyperplastic, especially their posterior tips, and no matter how straight the septum may be, the patient still complains of difficulty in breathing. The presence of polyps, especially the choanal type which hangs down in the nasopharynx, will cause marked obstruction in a nose which on superficial examination appears normal. Of course, the adenoid must always be suspect until proved otherwise, and chronic sinusitis must be ruled out as another cause of blockage.

Now for more details. Please remember that we are discussing rhinologic experiences in relation to orthodontics, and it is important that you be reminded of some of the things that can be of help to your patients.

Allergy is such a common affliction that even the average layman thinks of it in connection with every disturbing symptom. In rhinology, estimates run from 50 to 75 per cent of all patients we see may have an allergic basis, and in 85 per cent of these patients there is generally an associated sinusitis. So you see that just making a few scratch tests and giving some injections do not solve our problem. Both conditions must be treated simultaneously.

In the acute episodes of seasonal allergy, the tissues are edematous, there is very little change in the blood vessels and connective tissue, and they return to normal unless there are other complications. In the perennial or all-year hay fever, or allergic rhinitis, there ensues fibrosis of the connective tissue and the blood vessels, resulting in permanently diseased membrane.

All cases of intermittent nasal stuffiness with postnasal drip, frequent colds with partial loss of hearing, constant irritation in the pharynx with enlargement of the lymphoid follicles on the posterior pharyngeal wall, nasal discharge with irritation of the nasal vestibule, nonproductive cough, and recurring attacks of hoarseness are all borderline cases of allergy with or without definite sinusitis.

Heredity plays a significant part in allergy; 60 to 70 per cent have parents with some manifestation which may occur in any part of the body. The onset of asthma in many children is directly related to frequent so-called colds which are actually allergic reactions to bacterial infection in the lymphoid tissue of the nasopharynx. Besides the large masses of lymphoid tissues in the upper respiratory tract, the tonsils, adenoids, etc., of which you will hear more later, the entire pharyngeal mucosa is studded with lymph nodules which hypertrophy in allergic children.

In true uncomplicated allergy we find a marked eosinophilia in the nasal secretion, while with infections, neutrophilia predominates. But since pure allergy rarely exists without a certain amount of sinusitis, we cannot always differentiate the two conditions by studying the cytology of nasal smears alone. The family history, personal history, color of the mucosa, and the type of secretion give us a tentative diagnosis.

At this time I must say a few words about the use or rather misuse of nose drops. While it is at times necessary to give temporary relief, the constant use of nose drops eventually leads to a loss of tone of the nasal mucosa. The result is a thickened membrane which causes further blockage and headache and may lead to definite histologic changes and permanent damage.

Every effort should be made to find the cause of any symptoms, and if possible eliminate them. This is often very difficult. The allergenic tests may or may not be of help. The allergist or the rhinologist may find it advisable to give injections to desensitize the patient against the known allergens. At times it may be necessary to advise change of climate. Protective measures against various house dusts can be carried out to reduce the inhalation of many known factors. Elimination of offending foods often results in spectacular relief. Lately, several new so-called antihistaminic drugs have been developed which give temporary relief from the itching, swelling, sneezing, and discharge.

Before I go on to a discussion of sinusitis, another major cause of nasal blockages next to allergy, let us take up the problem of polyps. We meet with two divergent explanations as to the etiology. Some say all polyps are allergic, because they are constantly found in allergic noses. Experienced pathologists tell us that they are the result of chronic inflammatory reaction around the veins and lymphatics, a periphlebitis and a perilymphangitis. These vessels become obstructed, causing fluid to stagnate in the tissues, distending the stroma of the tunica propria. This is then followed by various degenerative changes in the surface epithelium, glands, and bone, with swellings which we call polyps. To put it in another way, polyps result from a stasis of the returning circulation, passive congestion, diminished drainage of the mucous membranes of the sinuses associated with distinct chemical changes of the proteins and tissues of the involved area.

Multiple polyposis is rather rare before puberty. In children I occasionally see huge polyps hanging down in the nasopharynx, completely blocking the posterior choanae. The nose generally shows no apparent pathology, and the child is often treated by the family doctor or pediatrician for a cold with the usual array of drops and sprays. The diagnosis is generally made by the rhi-

nologist after months of unnecessary suffering and expense. My last patient of this type was sent to Florida by his pediatrician to recover from his so-called cold. After being away all winter he returned home just as he had left, after getting further treatment by an allergist, who finally sought the rhinologist's opinion. The removal of these choanal polyps has heretofore been a tedious, traumatic procedure. A general anesthetic was necessary and it required four hands. It always ended with considerable damage to the soft palate. Being blessed with some mechanical ingenuity, I devised a simple instrument with which the operation can be done in a few seconds with light local anesthesia right in the office. This technique has been published and should be familiar to all rhinologists.

Now we go on to a discussion of those cases of sinusitis which result in chronic swelling of the nasal mucosa with almost continuous nasal blockage and varying discharge, producing mouth breathing with all its sequelae. The first fact I wish to stress is that many of these have an allergic background, and this must be considered of utmost importance in planning treatment. What is chronic sinusitis? In simple terms it means a head cold which has never cleared up. Why this has occurred depends on many factors. We all know that the mucous membrane lining the nose is continuous with that in the sinuses, and when the sinuses are involved the nasal membrane always is involved. Looking at the membrane, its color, consistency, the presence of pus, and the history give us a tentative diagnosis. In children the presence of pus and swollen membrane on one side should lead us to suspect a foreign body, something the child has pushed into the nose and forgotten about. These eventually become encrusted with calcium and other salts, and cause pressure necrosis. We see chronic sinusitis following scarlet fever, influenza, marked blockage from deviated septum with resulting deformity of the turbinates, polyps, malnutrition, and many other causes.

A nose which is physiologically and anatomically normal cannot become diseased except as a result of some temporary change in body metabolism. We are constantly inhaling dust composed of every possible irritant in nature, plus all kinds of bacteria, viruses, molds, etc. What makes us so resistant and why *do* we succumb at times?

First let us attempt to formulate a definition of acute sinusitis, or head cold, or upper respiratory infection. A "cold" is an inflammation of the mucous membrane of the nose, sinuses, and pharynx, creating changes in its contained elements, the blood vessels, nerves, lymphatics, and connective tissue. It is caused by a disturbance in the general metabolism of the body; in other words it is a general disease brought on by a great variety of conditions, such as overeating, exposure to cold or to excessive evaporation of bodily heat and perspiration, fatigue, lack of sleep, sudden changes in environment, in short anything which creates too much change from an individual's normal state. Perhaps the greatest predisposing cause is the modern method of heating our homes and places of business. Since no provision is made for proper humidification, the dryness of the heat leads to dehydration of the mucous membrane, thereby interfering with the viscosity of the blanket of mucus which must be kept in the

proper fluid state. This change in body chemistry activates a virus or viruses in the mucous membrane, preparing the tissues for invasion by the bacteria which may be present.

The nasal tissues are under normal cicumstances very resistant to infection. The cilia of the epithelium are powerful deterents to any bacteria trying to settle in the nose. These cilia, millions of them, acting like a huge army, just keep pushing the bacteria toward the posterior nares or choanae where, surrounded by a large amount of mucus, they are rendered incapable of settling down and doing harm and are spit up as part of the postnasal discharge or swallowed and inactivated by the stomach contents. But, in order that the cilia be able to do this, the layer of mucus which covers the nasal membranes must be of proper viscosity and sufficient in amount to move readily under the swaying action of the cilia. This does not ensue if there are obstructions to the normal intake of air. If the air is being drawn in by the action of the lung, which is more or less constant, through a narrowed channel, the current will go through at greater speed and, vice verse, if the channel is widened the air will have a tendency to lag. Both these occurrences have a direct effect on the mucous blanket. The narrowed area will have a tendency toward dryness, due to rapid evaporation, thereby weakening the action of the cilia, often destroying them and leaving such area easy prey to infection. In the more spacious side, the air stagnates, and there is not the proper suction of the air from the sinuses during inspiration resulting in mucous membrane changes leading to chronicity.

What can the rhinologist do for your patient under the previously mentioned circumstances? The most important problem is to discover the cause. Knowing this we can plan intelligently. All diagnostic aids should be used. I place x-ray studies last because I feel that the average doctor and the average radiologist are not sufficiently trained in sinus roentgenology to give an accurate diagnosis. History and direct inspection in most cases suffice. Since our problem is concerned with chronic cases only, we should begin by discussing the histopathology, which will show us why we have such difficulty in getting good results. Chronic inflammation of the sinuses and nose results in edema, fibrosis, and sclerosis, each of which contributes to lessen the nutrition to the parts involved. The sinuses undergo the same reaction as all inflammations of the body. Briefly, these changes are dilated and congested blood vessels with cellular stasis, migration of leucocytes into the tissue, appearance of lymphocytes, plasma cells, and other cellular forms in the walls of the vessels and the immediate perivascular tissue, associated with diffusion of serum into the adjacent structures. These reactions occur primarily in the walls of the blood vessels and perivascular spaces, and secondarily in the soft tissues. The acute inflammatory changes disappear as the irritation subsides, but it is an axiom in pathology that every inflammatory process, however small, leaves a disturbed tissue relationship usually in the form of an increased fibrous tissue content. It is also known that fibrosis leaves the tissue more sensitive to subsequent attacks. Repeated infections and inflammations ultimately produce fibrous changes of pathologic importance. If the chief change in acute inflammation is vascular, it logically follows that the greatest chronic changes are also vascular. The

distribution of these changes may be arterial, venous, or lymphatic. The type of chronic pathologic changes found in the soft and bony tissues depends upon which of the vascular channels is involved. Examination of tissues removed from the nose and sinuses in chronic cases shows us that in many cases the pathology is reversible to a great extent. We also know that surgery has not always resulted in cure; the replacement by scar tissue which is nonfunctioning cannot keep the operated sinuses in a healthy state. Therefore, we have sought means to cure our patients with the newer drugs—the sulfonamides and the antibiotics. We have not been successful in chronic cases. In desperation, I began to look back to the pathology and it struck me that because of the pressure on the blood vessels by the edema and fibrosis, the blood was not being carried to these tissues in sufficient amount to bring enough of the drugs in contact with the affected cells. It seemed to be reasonable that by increasing the blood supply through vascular dilatation, more drug-carrying blood would get through. I am happy to report (and this is the first public announcement of this work) that I have been successful in a small series of cases in clearing up the extremely stubborn type which resisted all previous medication and surgery. I hope to publish the details as soon as sufficient cases are studied.

Prevention of colds by eliminating all factors predisposing to sudden changes in metabolism is a big job and requires much study. If ever there comes the time when we can live in an air-conditioned atmosphere, we shall reduce the incidence of chronic sinusitis to a minimum. For the present I can only suggest that a cold be treated as early as possible by every known means. There is no one method and while the newer drugs are wonderful, they fail in many instances. These cases should be referred to the rhinologist who should seek the cause for the chronicity. I have trained my patients to seek early attention, and I now seldom see any serious cases; surgery is almost a thing of the past, even antrum irrigations are a rarity. With few exceptions chronic sinusitis should cease to be a problem when intelligently treated.

Another important phase of persistent respiratory trouble depends on the lymphoid tissue in the pharynx. I have on many occasions brought this to the attention of the orthodontist. I shall here briefly summarize our past experiences.

The early recognition of pharyngeal lymphoid tissue and tonsils as an etiological factor in malocclusion and in the abnormal development of the environmental tissues need not be stressed to such an audience as this. While there is no doubt that too many children have their tonsils and adenoids removed without proper indications, the result in selected cases is most gratifying.

For years, clinicians, allergists, and pediatricians have debated the problem of whether the blockage caused by adenoids and allergy was the cause of dental and facial deformity. Their experiences and deductions depended upon the social status of their patients, their heredity, and state of nutrition. Having been trained as a research worker, I am inclined to look to the testimony of men who use precision methods as against clinical deductions. In this work, I have followed the teaching of the late T. Wingate Todd. In his paper before the Thirty-third Annual Meeting of the American Society of Orthodontists in New York City on April 30, 1935, he stated: "Everyone knows, of course, that faces

differ, and most of us are content to assume that the differences are largely due to the hereditary tendencies implicit in the genes. But as the face, like the rest of the body, is a plastic thing and since the adult contours are the end-result of a growth pattern which, in the course of its progress, may be expedited, interrupted, retarded, warped or inhibited by misadventures of health and by the vagaries in the interplay of those organically originated influences by which the pattern is promoted, it is evident that environment, external and more particularly internal, must contribute in no small manner to the final result."

Todd was able to follow the natural history of the adenoid mass by precise roentgenograms. He found that at 12 months the adenoid showed as a definite shadow, that it increased in size to the age of 3, and remained stationary until adolescence, and then there was gradual recession unless aggravated by allergy. May I repeat his further comment: "Now if the respiratory passage thru the nasopharynx be choked by an adenoid mass, the only method of opening up a channel is the depression of the soft palate and this is most readily brought about as can be seen in roentgenograms by thumb sucking. I do not mean that adenoids are always the sole cause of mouth habits, but it is clear that the presence of mouth habits should direct one's attention to the naspharynx."

After the third year, in the average case, due to the progressive growth of the nasopharynx, it is sufficiently large to permit nasal breathing in spite of the adenoids, but because of frequent colds, the nasal mucosa may remain swollen, thus continuing the obstruction to breathing. In allergy, the adenoid shows marked fluctuation in size due to congestion just as the nasal mucosa. When the child's health is at its best, both in regard to weight and the season, the adenoid may not show on a film and therefore erroneous conclusions may be drawn.

Rosenberger, working in the anatomical laboratory at Western Reserve University, studied the growth and development of the nasorespiratory area with the aid of roentgenograms made on the Broadbent-Bolton cephalometer. He found that the widening of the nasopharynx is a growth phenomenon achieved by two growth changes: expansion of the wings of the sphenoid and the forward drift of the palate. If follows then that the pharyngeal tonsil, at the height of its lymphoid growth, may become an impediment to breathing.

What effect will enlarged and diseased tonsils and adenoids have on your patients, their nose, sinuses, and ears? In order to discuss this problem intelligently, we should briefly review some of the principles of nasal physiology. The main function of the mucosa is to warm, cleanse, and moisten the incoming air so that when it gets to the alveoli of the lungs it is properly prepared for absorption without causing irritation to the lung tissues. The nasal passages are covered with a blanket of mucus kept moving by the cilia. This mucus must be of the proper viscosity or the cilia will cease to function. Foreign substances are enmeshed in it and moved back to the nasopharynx. Physiologists tell us that the nasal mucosa gives up to the air passing through the nose about one litre of water in twenty-four hours. The air also absorbs from the abundant blood supply in the mucosa enough warmth to give the air a temperature close to that of the body itself. This it is able to do because of the enormous venous bed of

erectile tissue in the inferior and middle turbinates. The filling and emptying of this cavernous tissue are finely regulated by vasomotor nerves to meet the usual variations in the outside temperature.

What happens if the adenoid mass closes the nasopharynx? Various degrees of irritation in the mouth, ears, pharynx, and lungs lead to chronic involvement of all these tissues and, of course, to mouth breathing and all its sequelae. These effects come on slowly, causing often such slight symptoms that parents and physicians are apt to overlook them. This is especially true with the ears.

The chief complaints in children for which tonsillectomy and adenoidectomy are advised are: (1) cervical adenitis, (2) frequent sore throat, (3) involvement of the ears, (4) mouth breathing, (5) cough of nonpulmonary origin, and (6) frequent head colds. The good results in large series of cases can be summarized as follows: 92 per cent in adenitis followed closely by pharyngitis and otitis, 79 per cent in mouth breathing, and 70 per cent in head colds. As a rule, the best results are in the age group from 6 to 13 years. In children under 6, mouth breathing may persist in 26 per cent, whereas in the older group it averages 6 per cent.

In discussing results from this operation, the skill of the surgeon must be taken into account. In certain parts of the country, most of these operations are done by general practitioners, and therefore the results vary in proportion to the man's ability. I have come to the belief that tonsillectomy and adenoidectomy are the two operations most poorly performed in all the realm of surgery. Either too much is removed, resulting in scarring and inclusion of small, buried tonsil stumps deep under the scars, or pieces are left; both may continue to give symptoms. The voice is often affected, and sometimes there may be interference with the function of the soft palate. I have seen cases where the torus tubarius of the Eustachian tube has been cut away, and I have encountered atresia of the nasopharynx.

A very serious consequence of involvement of the ears from adenoids is deafness. At least 50 per cent of adult deafness can be traced back to early infections of the middle ear. These cases are very distressing to the doctor because little, if anything, can be done. Patients in their early years begin to realize that their hearing is down, and the mental tragedy which ensues is hard to realize. In the prime of life they have to give up the work for which they have trained for many years. Prevention, therefore, is our only hope. After meticulous surgery we can promise some benefit from the use of radium in the nasopharynx. This shrinks the lymphoid follicles in and about the Eustachian tube and permits ventilation of the middle ear. Often hearing in early cases is completely restored.

There are very few contraindications to this operation. Hemophiliacs and those with organic diseases who cannot take a general anesthetic should be left alone. At least four weeks should intervene before operation after any acute illness, especially in the respiratory tract. It is best not to operate during epidemics, or when there is great prevalence of respiratory infections. The time of year seems to make little difference; of course, very hot weather is enervating, especially in the young.

The age at which operation is best done must be determined for each case. Ideally, 4 to 5 years would be about right, but circumstances will vary. If the child is having frequent attacks of tonsillitis, with involvement of the ears, the sooner it is done the better. My youngest patient was 9 weeks old. At 3 weeks she caught cold and the mastoid became involved. Examination revealed an enormous adenoid which prevented the Eustachian tube from draining back into the nasopharynx. Without an anesthetic, I removed the adenoid and the ear cleared up in three days.

While we are discussing operations I should like to tell you about some research I have been doing during the past five years, which has been extensibly reported in the literature. I, like many other rhinologists, have always been greatly disturbed by the all too frequent incidence of late postoperative hemorrhage: that is, bleeding coming on at the end of a week. I felt that this was not due to any fault of the surgeon, rather that it was a biochemical problem. To study this much-neglected problem, I opened a special laboratory at Columbia University, which was named the Pharyngology Research Laboratory. I felt that the medical management of our cases was at fault either in what we gave the patient or what we omitted. I began to study the effect of various drugs used and soon discovered that the most frequently used sedative, aspirin, was causing most of the trouble. In a long series of blood chemistry studies we found that the prothrombin in the blood was destroyed by certain drugs, and that this could be prevented by giving Synkayvite or vitamin K. We could raise or lower the prothrombin level by the amount of drug and vitamin given. The same effect was gotten by using vitamin C. We therefore combined both and in the wards at the Presbyterian Hospital we reduced the incidence of hemorrhage to 1/10. Lately, I have studied the effect of restricted diet in these postoperative cases and found that because of pain, most patients did not get sufficient food containing the coenzymes necessary for the metabolism of proteins and carbohydrates. These coenzymes are found in the vitamin B complex. I therefore incorporated the essential factors of B with C and K. The result has been that the healing has been hastened, the appetite improved, and there has been less loss of weight. These water-soluble vitamins increase resistance by aiding detoxification processes and protecting capillary integrity; aid repair by promoting collagen tissue formation for better healing; aid in recovery by participating in metabolic functions essential to tissue growth and energy requirements.

I have tried to discuss some of the conditions the rhinologist sees which contribute to create abnormalities in the teeth and jaws. I am especially anxious to emphasize how the modern rhinologist, trained in plastic surgery, can enhance the fine work the orthodontist is doing, by certain procedures aimed to correct cosmetic or functional defects. Beautifully aligned teeth with correction of chin, lip, and nasal deformities make for a pleasing face and a happy patient.

555 Park Avenue.

ORTHODONTICS AS A PUBLIC HEALTH ACTIVITY

J. A. Salzmann, D.D.S.,* New York, N. Y.

THE question of orthodontics is no longer something that concerns those who have a lot of money. Orthodontics is too important in the life and welfare of children for such a limited view to prevail. The benefits of orthodontics are now appreciated by families of children of every economic level.

The "Principles for Public Dental Programs for Children," published by the Children's Bureau of the Federal Security Agency under the Social Security Administration, defines orthodontics as a public health function in the following terms:

> The correction of dentofacial deformities when efficiency of the dental mechanism is threatened by a present or potential condition which will cause tissue injury or interfere seriously with function or with mental or physical development.

In June, 1947, a conference was held at the Children's Bureau in Washington, to which a group of orthodontic consultants was invited further to discuss essential orthodontic health services for children. As a participant at this conference, I can say that the federal government, which presently supplies financial aid to programs for physically handicapped children, is interested in cooperating with state authorities and professional organizations for the furtherance of orthodontic care for the children of the nation.

The following is included in the recommendations formulated at the Orthodontic Conference held by the Children's Bureau in 1947:

> Public health programs in orthodontics should provide education in prevention of malocclusion for dental students, general practicing dentists, and other workers in the fields of child health and welfare.

In order to educate the dentist you have to catch him young. You would necessarily have to provide something for the dental student along the lines of preventive orthodontics. This task is not a simple one. Orthodontists are no exception to the rule that divergence of opinion exists among scientific health practitioners. One cannot imagine a profession dealing with biologic entities, with people, having a unanimity of opinion on methods and procedures. There are, however, what one might call accepted trends of thought, accepted practices, but certainly unanimity of opinion would have to be something handed down

---

Address delivered at the Dental Health Conference in a joint program of the Dental Society of the State of New York and the New York State Department of Health, conducted by the Society's Council on Dental Health, at the Hotel Statler, New York, N. Y., Oct. 25-27, 1948.

Published simultaneously by special arrangement with the *New York State Dental Journal*.

*Member of the New York State Advisory Committee on Orthodontics. Other members of the Committee are Dr. Franklin A. Squires, Chairman, Dr. Leuman M. Waugh, Dr. Joseph D. Eby, and Dr. Lowrie J. Porter, filling the vacancy left by the late Dr. Henry U. Barber.

from on high, and we do not want anything like that to operate in dentistry or in any other phase of the American way of life.

Another recommendation of the Children's Bureau reads:

Immediate service programs for children with severe dento-facial deformities, especially those with general health, psychosomatic and employability involvements.

Here, again, we come up against the same difficulty. No one has yet exactly defined the orthodontic conditions that affect general health. No one can put his finger on a specific orthodontic condition, a condition of malocclusion, and say that this has a severe psychosomatic involvement, although such correlations do exist. The same thing applies to employability. We know that a man with severe malocclusion who has "something on the ball" is going to get the job whether he is fit to be a motion picture star or whether he looks like something to scare children. In other words, there is more than appearance involved, when proved ability is present. Unfortunately, appearance is the first thing that we bring with us no matter where we go, whether it is to get a job, or in our social contacts, or any other place. It is of great importance to the young man or young woman getting started in life.

The question of psychosomatics is also very involved. We must reckon with the psychosomatically affected patients. You can take a child with her teeth "way out there," in severe malocclusion. As we say in orthodontics, she could "eat corn through a picket fence"; yet, the youngster gets along and may be "the life of the party" wherever she goes. On the other hand, you will find a child with one tooth out of line, and that tooth will take up almost all of the conscious thoughts of that child. You cannot confine the criteria for treatment to a physical basis only.

Still another recommendation of the Children's Bureau states:

Advisory Committees. It was recommended that state health departments undertaking orthodontic programs should appoint orthodontic advisory committees, preferably nominated by the district orthodontic society.

We believe that such committees can be of great help. I have good reason to believe that orthodontists are very anxious to cooperate in any public health activity.

An important need in public health orthodontics is to be filled for the children who are known as "facial cripples." I refer to the children with gross dentofacial abnormalities involving facial and palatal clefts. There are between 400,000 and 500,000 children in the United States with these conditions. The rehabilitation of these children requires a team approach in which the orthodontist plays an important role. Others in the team are the pediatrician, the medical social worker, the psychologist, the psychiatrist, the speech therapist, the prosthetic specialist, and other health workers.

I base the conclusion that there are between 400,000 and 500,000 children in the United States with facial and palatal clefts on the fact that in Europe they found that there was 1 child with a cleft to each 875. It has been estimated in the United States that we have about 1 in 800 to 1 in 1,000 children who have

a cleft of the lip or a cleft of the palate. Departments of health could very easily find out within a period of a year what the ratio is in cleft lip and cleft palate children. All they would have to do would be to include on the birth certificate a question as to whether there was a cleft of the lip or palate present at birth. That would make it necessary for the physician to look into the child's mouth when a child is born.

Our experience in the orthodontic care program in the state of New York and the city of New York should prove of value to others. In New York State, we have an Advisory Committee on Orthodontics functioning in connection with the Health Departments of the city and state of New York. This Advisory Committee has certain functions, and those functions were formulated with the help and cooperation of the Bureau of Maternal and Child Health of the State Department of Health and with the Bureau of Dentistry of New York City. These functions are as follows:

1. To advise the Department concerning the classification of handicapping malocclusions and whether or not selected patients fit into this classification.

2. To advise the Department as to training and experience necessary to qualify orthodontists for participation in the state aid program, and to advise concerning qualifications of individual applicants.

3. To advise the Department concerning an equitable fee scale for orthodontic care.

4. To review selected cases at periodic intervals and to advise the Department concerning the progress of treatment.

5. To advise the Department as to orthodontic educational programs and material for professional personnel, including dentists, physicians, nurses, dental hygienists, and other interested health personnel.

6. To prepare instructions to orthodontists *re* progress of treatment, preparation of diagnostic aids, etc.

While those are the functions of the Advisory Committee, some of them are not so easily accomplished, for the simple reason that we have not sufficient knowledge at this time for their accomplishment. In other words, we still have a long way to go before we can have a really satisfactorily functioning program, one that would suit the great majority of people. If this desired state has not yet been achieved, it is not because we have not tried nor is it because we have not had the utmost sympathy, understanding, and cooperation of the departments of health of the state and city of New York.

The orthodontic care program in the New York State Department of Health was instituted in 1944. Prior to that time, the New York State Department of Health approved requests for state aid for certain children requiring orthodontic care through its physically handicapped children's program. The malocclusion in these children was associated with some other defect, such as clefts of the lip and palate. It was recognized by the State Health Department, however, that there were other types of severe malocclusion, not involving surgical intervention, which presented serious handicaps to children in their normal physical and mental development, education, and employability later in life.

Dr. David B. Ast, Chief Dentist, Bureau of Maternal and Child Health, Department of Health of the State of New York, was designated by the then

State Health Commissioner, Dr. Edward S. Godfrey, Jr., to establish a more inclusive orthodontic care program. The Northeastern Society of Orthodontists, the orthodontic society in which the state of New York is included, was asked by Dr. Godfrey to suggest the names of men from which list an Advisory Committee on Orthodontics was chosen.

In March, 1947, the Committee on Orthodontics, in cooperation with the Bureau of Maternal and Child Health of the Department of Health of the State of New York, formulated the following classification of handicapping malocclusions that was to be included in the state orthodontic care program. In other words, we were asked to tell the state what we thought would be the malocclusions on which public funds should be spent. The committee at that time presented the following criteria for examination and acceptance of orthodontic care patients:

1. Malocclusions associated with cleft palate, cleft lip or ankylosis of the temporomandibular articulation.

2. Malocclusions resulting from severe structural deformities involving growth and development of the mandible and/or maxillae:

(a) Prognathism.

(b) Retrusion.

(c) Micro- or macro-development of the jaws.

3. Severe malocclusions resulting from disease or trauma of the mandible and/or maxillae.

4. Malocclusions resulting in disfigurement or speech defects which may present a serious obstacle to normal development, education and employment of the patient later in life. (Where speech defect is the result of malocclusion, this condition should be called to the attention of the school authorities so that the speech defect may be corrected as well as the malocclusion.)

Authorization for examination of a patient by a general practitioner of dentistry or an orthodontist may be made by the district health officer. If the malocclusion does fit into the established classification, or if the examining dentist is in doubt, he prepares diagnostic aids and forwards them to the Dental Bureau, State Department of Health, and informs the district health officer of this procedure.

The district health officer requests the examining dentist, if he is certain that the malocclusion does not fall into one of the groups in the established classification, not to prepare the diagnostic material referred to below.

Required diagnostic aids include the following:

1. A full mounted series of x-rays (minimum number of ten x-ray films).

2. A set of properly prepared study casts.

3. One true profile and one true full-face photograph showing head and neck only, with the mouth in rest position (minimum size 3½ inches x 5 inches) with posterior teeth closed.

The district health officer is then advised by the Dental Bureau concerning the eligibility of the case in the state aid program, who in turn notifies the person who originally referred the patient for care, and the examining dentist. The district health officer also assists in the preparation and submission of petitions for care under state aid following the established procedures.

There are specific methods by which authorization for examination and treatment of patients were laid down. There is a legal procedure involved in New York State.

Only qualified orthodontists listed on the Department's specialists' roster are approved to render orthodontic care under this plan. An orthodontist may be considered qualified if he is certified by the American Board of Orthodontics, and/or is a member of the American Association of Orthodontists, and/or the Northeastern Society of Orthodontists, or has the technical training and experience to meet the requirements for certification or membership. Any dentist may be certified if he can submit to the Advisory Committee on Orthodontics complete records of five satisfactorily completed cases. Hospital and other public clinics are certified if they are under the directorship of a certificant of the American Board of Orthodontics.

In New York City the orthodontic care program follows essentially the same procedures as the state program.

While much valuable experience has been gained in the actual conduct of the program, there are still many problems to be solved. The prime need at this time is an evaluation survey of the program to date. Such a survey has been advocated by the Advisory Committee on Orthodontics and is to be undertaken by the state and city of New York.

It is the feeling of those who are interested in this program that consideration should be given to the point where dental responsibility stops and where social service begins; what should be the responsibility of each, and if they overlap who is to take the responsibility and whose decision is to prevail. For example, there are certain cases where the social worker might undertake to establish whether a child should be accepted for treatment to be paid for by public funds even if he does not fit the specific categories as far as an actual physical orthodontic need is concerned. That is a serious question because it involves the point of view of the social worker as well as that of the orthodontist.

At no time should the dental opinion be subservient to that of the social worker when it comes to a professional question. At the same time we must respect and heed the findings of the social worker in deciding the need for treatment. As an example, the child who has only one tooth out of alignment or some other minor malocclusion would in general not be the type of case for which public funds should be expended. However, if it means the difference between doing something for the child to rehabilitate him or not doing anything for him but just letting him go on and build up a mental hazard against his dental condition, then it is worth while spending public funds for that purpose.

There are quite a number of questions to be considered in public health orthodontic programs. Among these are the following:

1. The degree of perfection that should be expected in a public health orthodontic program. We know that in the private practice of orthodontics we aim for perfection as we do in the practice of any other phase of dentistry. Unfortunately, in striving for perfection there is a great deal of time consumed, expense involved, and money expended. Should the public's money be expended for certain degrees of perfection that in many instances may not prevail

after the active orthodontic treatment is terminated? When you deal with living children, you can have it all planned out, but somehow the child's own make-up has something to do with what he is going to look like after you are finished with the treatment.

2. Preventive orthodontics today is largely among the undefinables. The greater part of preventive orthodontics forms the basis of general dentistry for children, and should be among the services that the general practitioner knows, understands, and can supply.

3. Degree of severity of the malocclusion to be treated in relation to the personality of the patient. This requires the cooperative efforts of the social worker, psychologist, psychiatrist, speech therapist, and others.

4. Fees for treatment. Orthodontics is a continuing process of treatment. There is a great deal of expense involved and there is an irreducible minimum to the fee to be charged.

5. Retention. The application of orthodontic treatment is not something in which you put on an appliance and you are finished, nor is it something in which you take off the appliances and you are finished. You have a period of tapering off or retention, and there should be consideration given to this from the standpoints of length of time required, services rendered, and costs involved.

6. Qualification of operators. I do not believe that we would be correct in saying that only those who are members of the American Association of Orthodontists, or only those who are certificants of the American Board of Orthodontics, should be allowed to practice orthodontics, unless those provisions are public law. At present, any dentist is allowed to practice orthodontics, but there should be certain criteria for accepting persons to render the service for children paid for by public funds. There must be certain basic qualifications that a dentist should possess before the State Health Department authorizes him to treat a child. The operator should show proof of his ability to perform satisfactorily this type of work. The state health authorities with expert assistance should make an appraisal of these qualifications, and if found satisfactory, add the applicant to the list of qualified operators to whom patients may be referred.

7. Number of cases under treatment. No practicing dentist or orthodontic specialist should in his own office have a case load which would practically exclude private practice.

8. Education. Education on the relationship between the dentist, the patient, the patient's parents, and the school authorities is important to the success of the orthodontic program.

9. Cooperation with the dentist. While the child is undergoing orthodontic treatment, his teeth should receive constant supervision and his general dental needs should be cared for.

654 Madison Avenue

MEASUREMENT OF OCCLUSAL CONTACT AREA EFFECTIVE IN MASTICATION

ALGIRDAS YURKSTAS, B.S., AND R. S. MANLY, PH.D., BOSTON, MASS.

IT SEEMS logical to expect that the most effective portion of the occlusal surfaces of the dentition, from the standpoint of mastication, will be the area which makes contact during occlusion. Certain other portions of the occlusal surfaces will attain close approximation but not actual contact. These areas are probably less effective in producing mastication of foods. The effectiveness of other areas would be expected to decrease rapidly with increasing separation of the surfaces until, at some undetermined distance, the opposing occlusal surfaces would add but little to the effectiveness of mastication. It is probably the contact and near-contact areas which constitute the actual food platform. Size of this area will depend upon the size and shape of the occlusal surfaces of the teeth, the degree of interdigitation, the height of the cusps, the amount of abrasion or rotation, and the extent or type of malocclusion.

The purpose of this investigation was to develop a method for measuring the occlusal contact area which is employed in masticatory function. It seemed important to select a principle for measurement that would place most value on the occlusal area which is actually in contact when the teeth come into occlusion, and to give a lesser weighting to the area which attains close approximation. Those portions of the surface which were a certain small distance out of contact should not be taken into consideration.

Several attempts have been made to assign an approximate value to the area available for mastication. In 1921 Ono[1] published a paper which mentioned an instrument, designated as an "area meter," by which he attempted to estimate the area of the uneven masticating surface. His equipment was not described enough to disclose what principle or method was used for its operation. His results are reported as mesiodistal and buccolingual dimensions rather than occlusal area, and for this reason there is a question whether or not his instrument actually recorded area. Hellman[2] employed a classification system based on the assumption that an ideal occlusion should have 138 contact points. He reported that a normal dentition possessed 93.2 per cent of the ideal number of contact points. All of these contact points were assumed to be equally effective in mastication, and no consideration was given to their possible variation in size, or to other portions of the occlusal surfaces which might come sufficiently near to contact to aid in chewing performance.

The technique developed by Stallard[3] provided a simple means of observing occlusal area. A wax bite impression of the full arch was photographed ,in order to note the presence of heavy or light contacts in the molar and premolar area. A judgment of good or poor occlusion was made from observation of the

From the Laboratory for Oral Physiology, Tufts College Dental School.

Supported by a grant from the Office of Naval Research under Task Order N7onr-468, 181-396. The instrument was mentioned briefly in a paper before the American Dental Association meeting in Chicago on Sept. 17, 1948, and the results presented in part at the meeting of the Northeastern Society of Orthodontists on Nov. 23, 1948.

wax registration. Dahlberg[4] carried out extensive studies on the number of contact points and occlusal surface area of the teeth of 917 persons. He recorded the number of teeth present and in occlusion, the surface area of molars and premolars, and classified the mouth according to a contact point scale. His method for measuring area resembled Stallard's technique. A patient was instructed to bite in centric occlusion into a wax plate 2 mm. thick. Light was passed through the wax, projected onto a photographic film, and the occlusal surface area was measured with a planimeter. A high correlation coefficient (0.84) was found to exist between the number of contact points and the occlusal surface area of a dentition.

It seemed to us that the techniques of Stallard and Dahlberg could easily be improved by selecting a wax for the registration which had the proper opacity, transilluminating the wax bite impression, and measuring the transmitted light by means of a photoelectric cell. By this technique a single value could be obtained for the contact area of molar and premolar teeth in one half of the dentition. This area would place the heaviest weighting on points making actual contact, a lesser weighting on those in close approximation, and would disregard surfaces which were some small distance out of contact. With a suitable apparatus such measurement of occlusal contact area might be carried out rapidly and precisely.

EXPERIMENTAL PROCEDURE

Preparation of Wax for Occlusal Registration.—Several trials were required in order to prepare a wax strip which was judged to have the proper thickness, softness, opacity, and cohesiveness. The first composition which seemed to be satisfactory was prepared from one sheet of Kerr's Black Boxing Wax and twelve sheets of S. S. White's Pink Base-Plate Wax No. 7. The wax was melted over water in a large beaker. Uniform sheets approximately 0.5 mm. in thickness were obtained by dipping a slightly smaller beaker containing ice cubes and water into the layer of melted wax. The wax was cut from the bottom of the beaker, and that on the sides of the beaker was removed by scoring and unfolding the layer. A thin piece of cellophane was fused between two sheets of the wax so prepared, in order to provide an "occlusal sandwich" having sufficient strength to withstand occlusal forces without tearing. Sections two inches long and one inch in width were cut from a larger sheet. The finished occlusal sandwich was approximately 1 mm. in thickness. These sections provided sufficient area to record all teeth from the cuspid to the third molar on one side of most dentitions without causing discomfort to the patient. The sandwich was prepared for an impression by warming it uniformly and gently in an open flame.

More recently the procedure has been modified in order to avoid some of the temperature variations inherent in the flaming process and opacity variations among different batches of black wax. The change required development of a new composition, consisting of 58.4 per cent of S. S. White's Pink Base-Plate Wax No. 7, 40.9 per cent of Royer's Black Boxing Wax, and 0.7 per cent of Ivory Black (M. Grumbacher, New York). The wax was melted in a beaker

over water, and the ivory black was added. The water was boiled for one minute, the beaker removed from the heating element, and the sheets were prepared shortly thereafter. An infrared lamp was employed to fuse the wax firmly to the cellophane. This permitted the sandwiches to be warmed by immersion in water. It was found that the area obtained from subjects increased as the wax was heated to a higher temperature prior to taking a registration. A temperature of 125° was found to provide the best correspondence with values obtained by a careful use of the open flame technic.

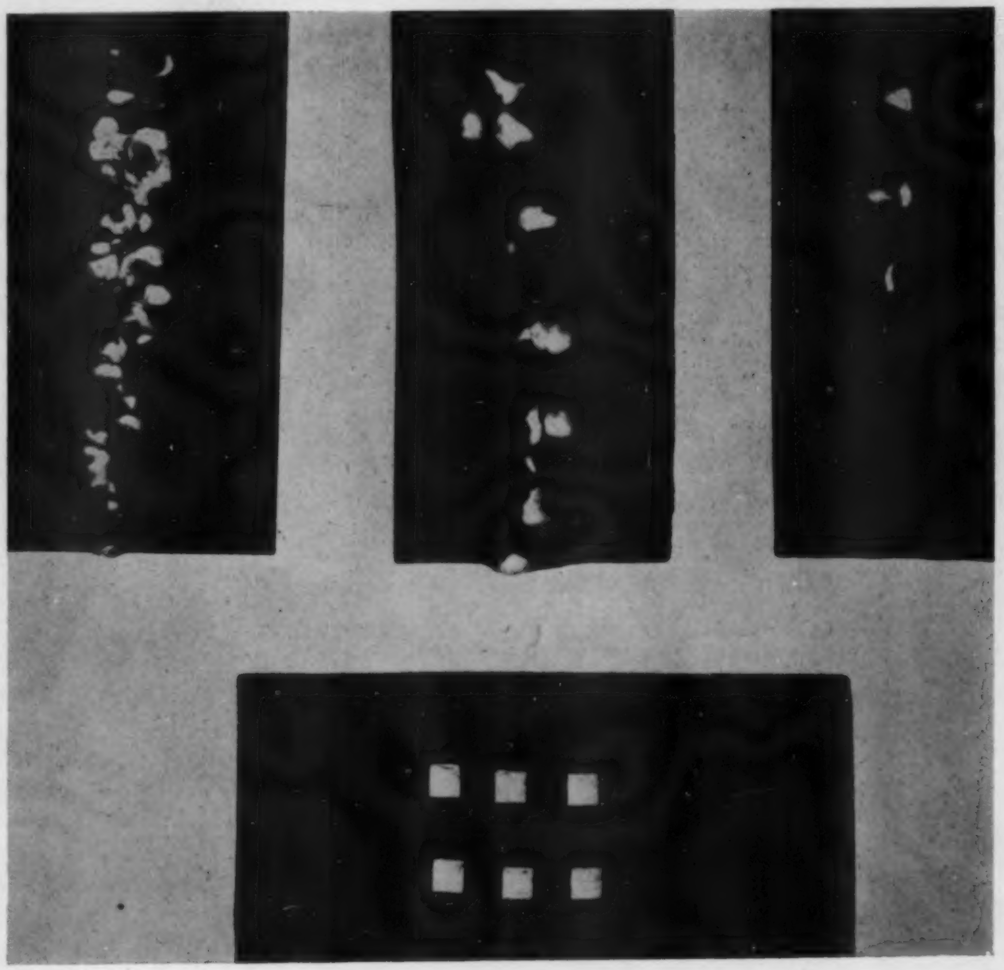


Fig. 1.

Oral Procedure.—A warmed occlusal sandwich was placed in the subject's mouth and centered over the lower molars on one side of the dental arch. Care was taken to extend the sandwich at least one-sixteenth of an inch beyond the last tooth present. The subject was then instructed to close slowly in centric relationship and to exert his maximum force on the occlusal sandwich for approximately five seconds. The occlusal registration could then be removed from the mouth readily since saliva acted as a separating medium. If the periphery

was distorted, it was flattened while the wax was still in a plastic state. Extreme care was taken to insure that the subject closed in centric relationship and that there was no lateral jaw movement while taking the registration.

The occlusal registration showed an impression of the occlusal surfaces of the teeth with cusps, fossae, and grooves reproduced, and the relative distance between various areas was indicated by differences in the thicknesses of the wax. Fig. 1 presents examples of poor, average, and good contact areas on wax registrations. If any tears in the registration could be noted visibly, the sandwich was discarded and a new impression taken. When large deviations occurred between patterns, they were observed to be attributable to lateral excursions, tearing, or a false centric relation.

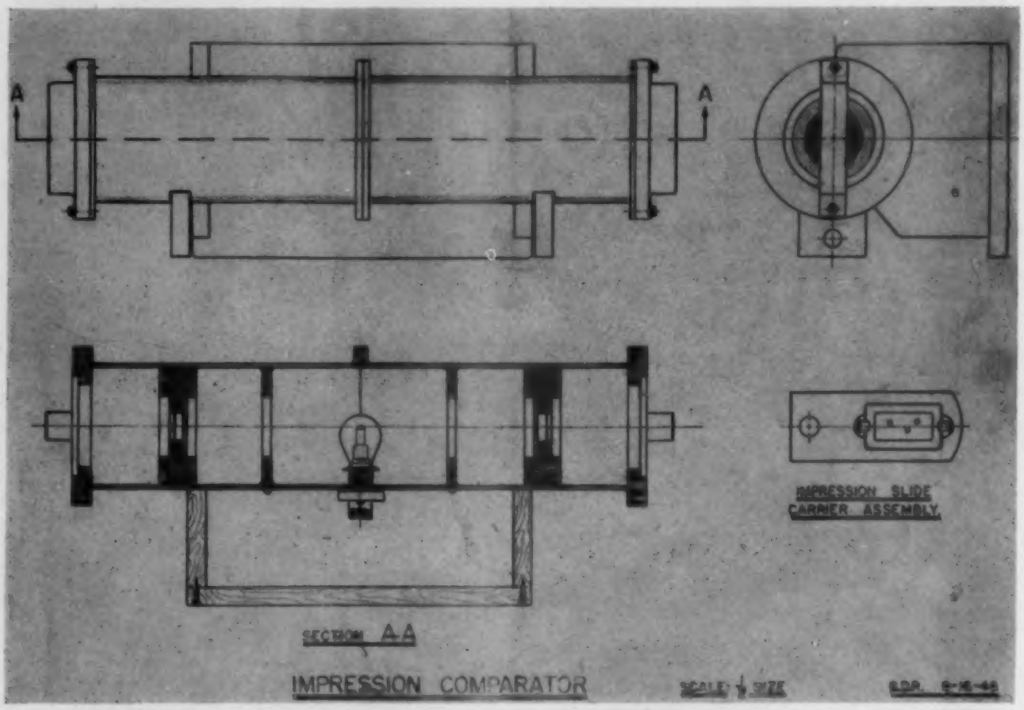


Fig. 2.

Details of Instrument Construction.—A sketch of the comparator is presented in Fig. 2, and a photograph of the whole assembly is shown in Fig. 3. The comparator consists of a brass cylinder 4 inches in diameter and 17 inches long. The light source is a 15 candle power, 6 volt automobile headlight lamp. It is located in the center of the cylinder. Two slots are provided near either end, exactly 5 inches from the light source. The occlusal registration and the standardized pattern are adapted to the slides that fit into these slots. A photovoltaic type cell* is located at either end of the unit. One of the cells serves as the measuring cell and the other provides bucking current in order to assure greater stability in the instrument. Baffles are positioned in the tube 2.5 inches from the light source, in order to eliminate some of the light which is reflected

*No. 755 cell in Bakelite housing with cable, from Photovolt Corporation, New York City.

from the inside surface of the blackened cylinder. The output from both photocells and the current supply for the lamp are connected to a six-prong plug that fits in place of the search unit of a model 610 Photovolt reflectometer.

Standardization and Operation of the Instrument.—The method chosen for standardizing the instrument permitted readings to be made directly in square millimeters of occlusal area. Thin brass squares, 10.2 square millimeters in area, were soldered to crucible tongs. When an occlusal sandwich was squeezed with these impression tongs for five seconds, an area of 10.2 square millimeters was registered on the sandwich. A standardized force of 36 pounds was employed.* An occlusal registration with three unit areas impressed upon it was placed in the bucking slot. An unimpressed sandwich was then placed in the measuring slot and the galvanometer readings set to zero with the two knobs provided on the left side of the Photovolt reflectometer. Next a six-impression

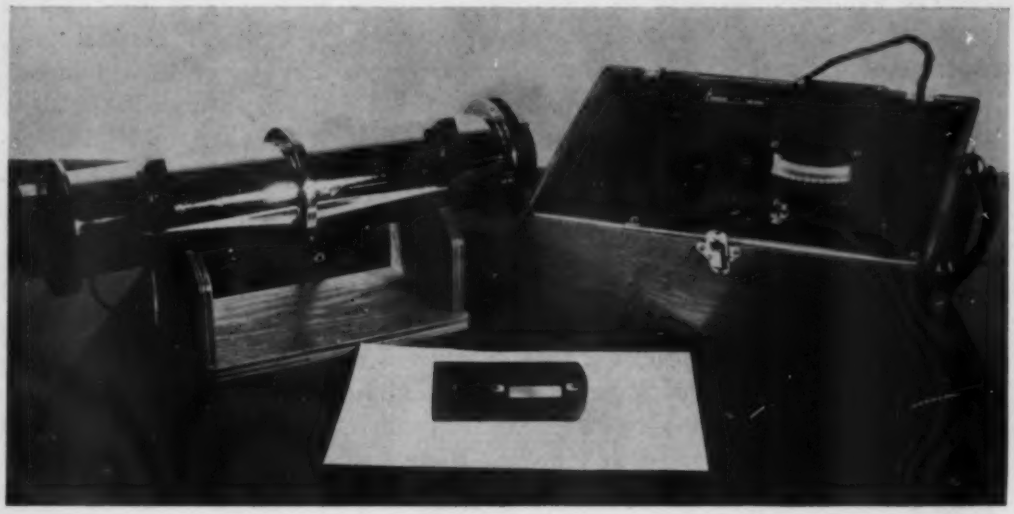


Fig. 3.

standard (shown in Fig. 1) was placed in the measuring slot and the readings adjusted to 62 with the knobs on the right side of the reflectometer. All adjustments after this were minor and made with the knobs provided on the right side of the panel. After adjustment with the zero- and six-impression registrations, it was found that readings on the 31, 62, and 92 square millimeter registrations agreed with the actual area within one square millimeter.

After the instrument had been standardized, an occlusal registration was adapted to the measuring slide. The slide was inserted into the proper position, the switch turned on, and the reading noted. The registration was then removed, another inserted, and readings taken again. Between readings the instrument was turned off. It was found advisable to position the registration in the center of the slide, to keep the impression of the maxillary teeth toward the light source, and to locate the distal aspects of the teeth on the impression toward the rounded portion of the slide. (See Fig. 2.) This procedure resulted in smaller deviations between readings.

*Determined by the Howell-Manly Oral Force Meter, J. D. Res., December, 1948.

The standard deviation of repeated readings on the same registration amounted to 0.8 square millimeters as determined from duplicate readings on 80 patterns. The error in taking occlusal registrations of the same individual was larger and was observed to be 4.7 square millimeters as determined from 100 repeated readings. About three-fourths of the deviations were less than 4 square millimeters, and a few large errors were responsible for raising the standard deviation to 4.7 square millimeters.

Tests on 25 individuals were made with the first wax composition. Six months later registrations were made on the same individuals with sandwiches prepared according to the second procedure. The self-correlation coefficient between the two sets of readings was found to be 0.91.* These errors are sufficiently small to indicate that the instrument is stable and the method is precise enough for the purpose.

The equipment is easy to operate and rugged in design. After the wax registrations have been prepared and the instrument has been standardized, readings of occlusal contact area can be obtained within two or three minutes. The results are objective and reproducible by different operators after a short training period. These features make the instrument suitable for clinical observations.

Effective Occlusal Contact Area of Individual Teeth.—Wax registrations of right and left molars and premolars were obtained in duplicate for 50 subjects. The subjects were instructors, students, or employees of Tufts College Dental School. Their mean age was 26.3 ± 4.9 years and the range was from 19 to 40 years. Forty of the subjects were males and ten were females. One set of the duplicate registrations was placed with the maxillary tooth impressions face up on a table. Cuspid impressions were generally not obtained, but where they did appear and were not covered by the slide, their area amounted to 0.4 millimeter. One maxillary tooth impression was blacked out on the occlusal registration by flowing wax into the impression. A new reading on light transmission was obtained. The difference between the two readings represented the contact area of the tooth which was blacked out. This process was repeated for the remaining maxillary tooth impressions. The second set of registrations was placed with the mandibular surface upwards, and impressions of the mandibular teeth were blacked out consecutively in order to obtain their surface area. After all tooth impressions had been filled with wax, it was found that patterns were more opaque than the original unimpressed pattern by 1.5 units on the average. This difference is attributable to the wax added in the blacking-out process and constitutes a minor error in the technique.

RESULTS

The experiments on 50 subjects yielded 200 duplicate impressions of right and left molar and premolar teeth, on which over 3,000 area readings were obtained. A summary of the data for individual teeth and for the total area of maxillary and mandibular teeth is shown in Tables I and II. The num-

*Calculated according to the equation $r_{xy} = \frac{\Sigma xy}{N\sigma_x\sigma_y}$ (5)

ber of observations is presented in the first column and the mean area in the second column. The third and fourth columns present the standard error of the mean and the standard deviation of a single determination. The remaining five columns provide an indication of the wide spread which existed among the various values. For example, the minimum reading on the maxillary first molar (Table II) was found to be 1 square millimeter, 25 per cent of the values were less than 10, and the median was 16; 75 per cent of the readings were less than 24, and the maximum area was 40 square millimeters. A similar wide range held for the remainder of the teeth and for the total area.

TABLE I. MANDIBULAR ARCH. ANALYSIS AND DISTRIBUTION OF CONTACT AREAS ON MOLAR AND PREMOLAR TEETH

	NUMBER OF OBSERVATIONS	MEAN	σ_m*	σ†	MINIMUM VALUE	25% VALUE	MEDIAN	75% VALUE	MAXIMUM VALUE
First premolar	99	3.6	0.23	2.3	0	2	3	5	14
Second premolar	90	5.4	0.41	3.8	0	3	5	7	18
First molar	79	16.4	1.03	9.1	0	10	16	22	50
Second molar	93	12.5	0.88	8.4	0	6	11	18	38
Third molar	39	6.9	0.73	4.5	0	3	6	11	17
Whole quadrant	100	34.9	1.95	19.5	2	20	34	46	87

*σ_M = Standard Error of Mean

$$\sigma_M = \frac{\sigma}{\sqrt{N - I}}$$

†σ = Standard Deviation

$$\sigma = \sqrt{\frac{\Sigma\gamma^2}{N}}$$

TABLE II. MAXILLARY ARCH. ANALYSIS AND DISTRIBUTION OF CONTACT AREAS ON MOLAR AND PREMOLAR TEETH

	NUMBER OF OBSERVATIONS	MEAN	σ_m*	σ†	MINIMUM VALUE	25% VALUE	MEDIAN	75% VALUE	MAXIMUM VALUE
First premolar	94	3.6	0.28	2.7	0	2	3	5	13
Second premolar	85	6.4	0.46	4.2	0	4	6	10	19
First molar	85	17.0	1.01	9.3	1	10	16	24	40
Second molar	90	12.6	0.72	6.8	2	5	11	16	32
Third molar	35	6.1	0.77	4.5	0	3	8	10	18
Whole quadrant	100	34.7	1.85	18.5	3	21	33	43	85

*σ_M = Standard Error of Mean

$$\sigma_M = \frac{\sigma}{\sqrt{N - I}}$$

†σ = Standard Deviation

$$\sqrt{\frac{\Sigma\gamma^2}{N}}$$

One hundred observations were made on the total maxillary and mandibular areas of one side of the mouth. There were fewer than one hundred readings on individual teeth because certain teeth were missing from the arch and were not included. If a tooth were present in the arch but did not make occlusal contact, a zero was recorded for the contact area of that tooth. Because of certain teeth not in occlusal contact, the mean total area is not as large as the sum of areas for individual teeth. For example, the average area for one side of the

mouths examined was 34.7 square millimeters. The sum of the average areas of individual molars and premolars amounted to 45.7 square millimeters. This area is similar to the average, 48.4 square millimeters, for the 21 sides of mouths having complete dentition.

The total maxillary area is almost identical with the total mandibular area, as was to be expected. It was not anticipated that corresponding maxillary and mandibular teeth would have the same contact area, yet the average areas are so similar that there is no statistical difference between them. The similarity can be seen by comparing averages for single teeth in Tables I and II.

Apparently the first molar provides a greater proportion of the chewing area than any other tooth. In a complete dentition this tooth accounts for 36.7 per cent of the total area on the average. The next largest area is provided by the second molar, which contributes 27.9 per cent of the total area. The third molar and second premolar account for 15.4 and 12.9 per cent of the total, respectively, and the first premolar provides merely 8.1 per cent of the total. The same order of importance holds if one considers the median area for each tooth or the maximum area which has ever been observed.

DISCUSSION

It is recognized that the area readings are dependent upon the thickness, opacity, and softness of the wax and the temperature at which the registration is made. The original thickness of the wax will determine how far surfaces must be from occlusal contact in order to be neglected completely by the measurement. The opacity of the wax will determine how much weight will be given to surfaces in actual contact and to those in near-contact; greater opacity will cause less emphasis to be placed on near-contact areas and more on those in actual contact. A hard wax will cause values to be low for persons who have a small biting force, whereas a soft wax tends to disregard the maximum force that can be exerted by the subject. The temperature of the wax at the time of introduction into the subject's mouth has a similar effect in that a higher temperature produces a softer wax and minimizes the influence of the force which the subject can exert. It is expected that further investigation may show the need for minor changes in opacity, softness, thickness, and operating temperature.

The basis for believing that the adjustment of these four variables is now approximately correct arises from the good correlation which has been found between the area of measurement and performance in mastication. The correlation coefficient between these two measurements was found to be 0.84 for 25 persons. The details of the experiments dealing with masticatory performance will be presented elsewhere at a later date by one of us (R. S. M.). Since the area has been found to be well correlated with effectiveness of mastication, it seems likely that the readings which the instrument provides are a good measure of effective occlusal contact area.

The average area for a group of subjects may be altered by improvements that are made later in the wax composition, and thus we cannot be certain that the average areas in Tables I and II are representative of the general population. There is question concerning their representativeness for another reason. Sub-

jects in this group had better opportunity than normal for receiving dental treatment. The relative area of each tooth, or the per cent which it contributes to the total area, is probably less affected by the composition of the wax and by the type of subject included in this sample.

The effective occlusal contact area is only a small fraction of the total occlusal surface area. The two types of area are compared in Table III. Dahlberg's average for occlusal area of a mouth with good dentition has been divided by two in order to be comparable with our figures for one arch. G. V. Black's measurements[6] have been used to calculate the area of the occlusal surface, assuming the surface to be elliptical.* The effective area in one arch is only one-tenth of the surface area calculated from Black's measurements, and one-sixth of that reported by Dahlberg. It seems likely that this small area is all that is effective, for Dahlberg found a poor correlation between his measured area and his estimate of chewing performance, whereas our correlation between our two measurements is high.

TABLE III. OCCLUSAL AREA OF ONE SIDE OF THE MOUTH ACCORDING TO DIFFERENT AUTHORS

	SQUARE MILLIMETERS					
	MOLARS			PREMOLARS		
	THIRD	SECOND	FIRST	SECOND	FIRST	TOTAL
Black	77	86	96	47	43	349
Dahlberg	–	–	–	–	–	217
Yurkstas and Manly	6.5	12.6	16.7	5.9	3.6	34.8

TABLE IV. PERCENTAGE OF OCCLUSAL AREA PROVIDED BY SINGLE TEETH

	MOLARS			PREMOLARS			
	THIRD	SECOND	FIRST	SECOND	FIRST	CANINE	INCISORS
Feiler[7]	25	25	25	12.5	12.5	0	0
Hentze[7]	0	32	32	15	11	5	5
Rohrer[7]	10	20	20	20	20	5	5
Dahlberg[4]							
Contact points							
Maxilla	15	23	23	15	15	8	–
Mandible	23	23	23	15	15	–	–
Black[6]	22	25	28	14	12	–	–
Yurkstas and Manly	15.4	27.9	36.7	12.9	8.1	–	–

Our results place more emphasis on the importance of the first molar from the standpoint of area than do the estimates made by previous investigators. Most of the previous estimates have been based on the number of theoretical contact points for each tooth. These have been calculated to a percentage basis in order to be comparable with our data, and are given in Table IV. Black's area figures from Table III are recalculated in Table IV as percentage. In previous estimates, the first and second molar have been given nearly equal importance in mastication. This is not consistent with our findings from actual measurements in the mouth. From the literature it would appear that the first molar contributes between 20 and 32 per cent of the total area for mastication, whereas our findings indicate that it actually contributes nearly 37 per cent of

*Calculated according to the equation $\frac{\pi}{4}$ (length × width).

the total area. Our measurements for the second and third molar and the second premolar fall within the ranges which have been previously assigned to these teeth, but our data on the first premolar indicate that it is less important in mastication than has been assumed by other authors.

The importance of area to the individual is suggested by a comparison between the area of each side of a person's mouth and his statements concerning which side he usually employed for mastication. Among the 50 persons examined, 44 had a difference in area between the two sides of the mouth; 25 preferred to masticate on the side having the greater area, 14 had no preference, and only 5 preferred the side with the smaller area.

Some consideration was given to the question of whether loss of a tooth tends to bring about a change in the effective occlusal contact area between the remaining teeth. For example, tilting of a molar adjacent to a missing tooth might cause a decrease in the area of contact between the molar and its antagonist, or, on the contrary, the loss of a tooth might be compensated to some extent by an increased contact area between the remaining teeth. The data were regrouped in order to disclose whether the contact area of remaining teeth was altered by the loss of one or more teeth. These data are presented in Table V. The total area is reduced most by loss of the first molar, less by loss of the second molar, and least by loss of the third molar. Yet it can be seen that there is no important change in the area of remaining teeth as teeth are lost. These results do not suggest that there is much adverse effect from the loss of teeth on the area of contact between remaining teeth, and do not give evidence of any compensation for the loss in total area which has occurred.

TABLE V. EFFECT OF MISSING TEETH ON OCCLUSAL CONTACT AREA OF REMAINING TEETH

TOOTH NUMBER TEETH MISSING	4	5	6 AREA IN SQUARE MILLIMETERS	7	8	TOTAL
None (42)*	3.2	5.8	18.5	14.5	6.4	48.4
Third molar	3.4	5.7	17.1	11.2	-	37.4
Second molar (6)	3.0	6.9	15.3	-	8.3	33.5
First molar (17)	4.2	8.5	-	11.9	6.8	31.4

*Figures in parentheses refer to number of half-dentitions comprising the average.

The findings suggest that there may be differences between the average contact areas for males and females. Of the ten females included in this investigation, only one had a complete dentition, including third molars. For this reason, the comparison was made on those subjects who lacked third molars. In this group were 7 females and 13 males. The mean area for females was 27.6 ± 2.6 square millimeters and for males was 38.4 ± 2.1 square millimeters. The number of subjects is too small to justify placing much reliance on the apparent difference, but there is an indication that the difference would become statistically significant if more subjects were examined.

There are several possible clinical applications of this technique. Measurement of occlusal contact area might be of value in dental practice for helping to formulate a treatment plan or for demonstrating the extent to which the functional efficiency of a mouth has been improved by dental operative procedures. Because the findings are well correlated with performance in mastication, the instrument could be used for predicting masticatory performance, and

as such would be a better index of performance than could be obtained by counting the number of teeth in occlusion. For example, one of the subjects examined had a complete dentition but her occlusal area was merely 11 square millimeters, which is only one-fourth as great as the average for the group having complete dentitions. The technique might also be employed during orthodontic treatment to express the degree of malocclusion as distinct from the type and to follow improvement in degree during the course of treatment.

SUMMARY

An instrument has been developed for measuring the effective occlusal contact area of molar and premolar teeth of one side of the mouth. Subjects are instructed to bite in centric occlusion on a special strip of wax consisting of cellophane fused between two layers of soft opaque wax. Light is passed through this occlusal registration in a cylinder containing a light bulb and two photovoltaic cells. The total quantity of light which passes through translucent areas of the registration is measured on a galvanometer whose scale is calibrated to read in square millimeters of effective occlusal contact area.

Area measurements have been made on molar and premolar teeth of 50 subjects. Individual teeth in the registration were blacked out, and the area provided by each tooth was determined by the difference in readings. The area of corresponding maxillary and mandibular teeth did not differ significantly. The average effective occlusal area was 34.8 square millimeters for all subjects and 48.4 square millimeters for those having a complete dentition. The area measured in this manner was only a small fraction of the total occlusal surface area, yet it probably represents the fraction of total area which is involved in mastication because it was found to be well correlated with masticatory performance. The first molar provided 36.7 per cent of the total effective area in a complete dentition. The second molar, third molar, second premolar, and first premolar followed in order of decreasing relative contribution to the total area, with percentages of 27.9, 15.4, 12.9, and 8.1 per cent, respectively.

Possible applications of the technique include prediction of chewing performance, assistance in formulating treatment plans, and demonstration of improvement in effective contact area of molar and premolar teeth during orthodontic treatment.

The authors are pleased to acknowledge the advice and encouragement of the late Dr John T. O'Rourke during the early stages of developing the equipment. The improved procedure for preparing occlusal wax strips was developed by one of us (R. S. M.) with the assistance of Miss Louise C. Braley.

REFERENCES

1. Ono, I.: Dental Cosmos 63: 1278, 1921.
2. Hellman, M.: Dental Cosmos 63: 608, 1921.
3. Stallard, H.: J. Am. Dent. A. 13: 1392, 1926.
4. Dahlberg, B.: The Masticatory Effect, Oslo, 1942, Lund.
5. Guilford, J. P.: Fundamental Statistics in Psychology and Education, New York and London, 1942, McGraw-Hill Book Company, p. 202.
6. Black, G. V.: Descriptive Anatomy of the Human Teeth, ed. 4, Philadelphia, 1902, S. S. White Dental Mfg. Co. pp. 16 and 17.
7. Taken from Dahlberg,[4] p. 64.

THE GNATHOTRANSIT

ROBERT NEWTON HARPER, D.D.S., DANVILLE, VA.

THE value of symmetroscopy as a fundamental aid in orthodontic diagnosis has been accepted by the majority of the leading orthodontists.

Through the use of the symmetroscope, says McCoy, "not only may the approximate length and breadth of desirable dental arches be computed, but arch symmetry or lack of symmetry and necessary individual tooth movements can be estimated." And Huneeus says: "To prevent development of anomalies in occlusion, the dental practitioner should thoroughly survey and chart the vertical, transverse and sagittal relations of the teeth of each child under his observation."

Various types of symmetroscopes and symmetrographers have been devised, some of which are very complicated, while others simply offer a means of comparing both halves of the maxilla. But, even if the aim of such an examination is to be limited to two-dimensional symmetry, it is essential to have as a sagittal axis a structure, the formation of which is independent of the position of the teeth, such as the median raphe, and to have as a center on this axis, from which lines and angles can radiate, a formation that is stable and easily located, such as the incisive papilla, the prominent formation at the anterior end of the median raphe.

On the gnathotransit, these lines and angles are a ruled horizontal extension and a circular protractor, divided into halves, 180° for each side with an angle indicator (Fig. 1), which radiate from a perpendicular extension, the base of which rests on the incisive papilla.

However, if the scope of the examination is to be broad, it must not only include measurements in three dimensions, viz, length, breadth, and height, but also as the relative position of the denture in the skull is vital to a diagnosis, these measurements must be made with a denture-instrument orientation similar to the denture-skull orientation.

This same relationship is necessary in making a survey to compile statistical data on the position of the occlusal plane within the skull, the growth of the posterior teeth below the plane, the degree and comparative height of the curve of Spee, the transverse inclination of the occlusal surfaces of the posterior teeth, as well as to make a study of the inclination orientation of the entire maxilla.

Such orientation relationship can be obtained by mounting the denture in such a manner that the plane of its symmetry axis (median raphe plane, Fig. 2) will be perpendicular to the horizontal. This is accomplished by recording the relationship of the denture in the skull to the horizontal, in both the transverse

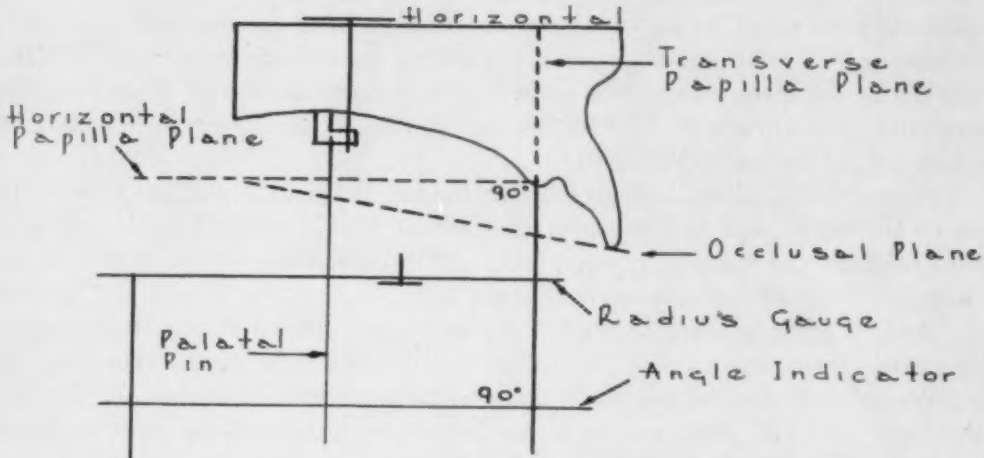


Fig. 1.—Sagittal view of the gnathotransit, indicating the horizontal papilla plane which is established by obtaining, by virtue of the adjustability of the palatal pin, parallel relationships of the resting surfaces of the palatal and papilla pins to each other and to the top of the model.

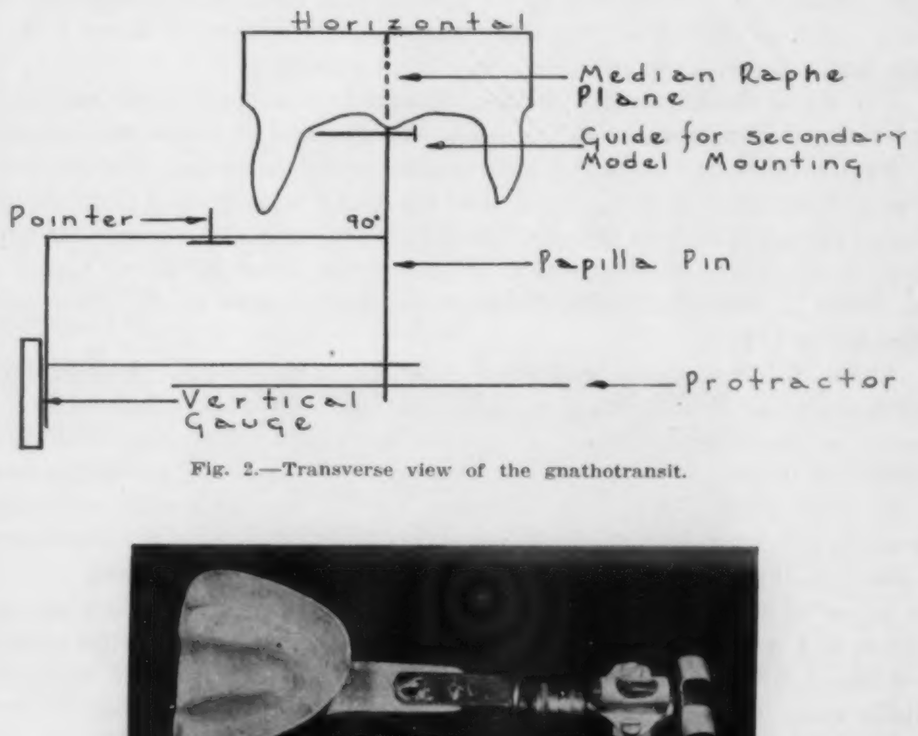


Fig. 2.—Transverse view of the gnathotransit.

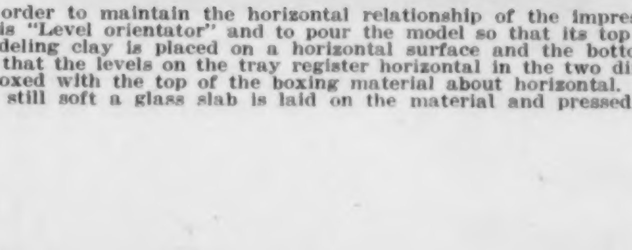


Fig. 3.—In order to maintain the horizontal relationship of the impression to the skull as obtained by this "Level orientator" and to pour the model so that its top surface will also be horizontal, modeling clay is placed on a horizontal surface and the bottom of the tray is pressed into it so that the levels on the tray register horizontal in the two directions. The impression is then boxed with the top of the boxing material about horizontal. The cast is then poured and while still soft a glass slab is laid on the material and pressed down until it is horizontal.

and sagittal directions. Fig. 3 shows the "level orientator," composed of a tray attached to two spirit levels, which are adjustable. After the impression is made, the head is held in an upright position (accepted as the horizontal position of the skull), and the levels are regulated to register horizontal in two directions. In mounting, this horizontal registration is maintained and the model is poured so that its top surface is horizontal.

A mechanical plane touching the surface of the papilla and parallel to the top of the model will be horizontal (horizontal papilla plane, Fig. 1) and perpendicular to the median raphe plane. This horizontal papilla plane is the "base line" for all vertical computations.

And, a plane passing through the papilla and perpendicular to the top of the model (transverse papilla plane, Fig. 1) will form right angles with the other two planes and, just as the median raphe plane is used to divide the denture into right and left segments, so is the transverse papilla plane used to divide the denture into anterior and posterior portions.

The transverse papilla plane passed through the cuspids, and in a study of its position of relationship to the cusp of the cuspid, it was found, as pictured in Fig. 4, that in cases with the "mean normal" profile the plane passes through the mesial half of the cuspid. When the plane is distal to the cusp, abnormal profiles, such as created by broad, flat arches are in evidence. When it is close to the mesial surfaces the profile is pointed and narrow.

Fig. 4 also shows how the profile is affected by the length of the radius from the transverse papilla plane to the mesial incisal edges of the central incisors.

Furthermore, it was found that symmetrical relationship between the anterior and posterior sections of the denture might be diagnosed from the proximity of the point of intersection of the median raphe and the transverse papilla planes to the point of intersection of lines from the mesiobuccal cusp of the first molar on one side to the distal of the first incisors on the opposite side (Figs. 5 and 11).

Simon believed that the denture must be orientated to the skull, and he used his orbital plane, which has approximately the same relationship to the denture as the transverse papilla plane, to connect it with the skull, thus enabling him to determine the normal or abnormal relationship of the entire maxilla to the skull itself. In the gnathotransit method the denture is orientated to the skull, but not necessarily connected with it. Fig. 6 shows the gnathotransit in place on the model with its mechanical planes perpendicular and parallel to the top of the model. This alignment of instrument and model is obtained by the use of a spirit level and, as shown in Figs. 1 and 15, the sagittal alignment is obtained by the foot of the papilla pin resting on a selected spot on the papilla while the foot of the palatal pin is resting on and in line with the median raphe. Model-instrument stability is obtained by seating the point of the papilla pin into the model (Fig. 1) and the use of a clamping device from the foot of the palatal pin to the top of the model.

The data obtained from the survey of Case 1 are recorded in Tables I and II. Fig. 7 is a graph of data in Table I and shows the relationship of the incisal edges of the anterior teeth and the buccal cusps of the posterior teeth

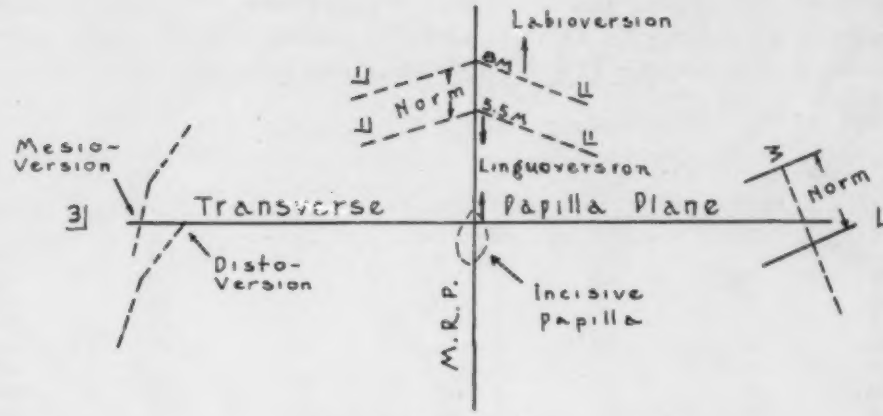


Fig. 4.—Profile indicator.

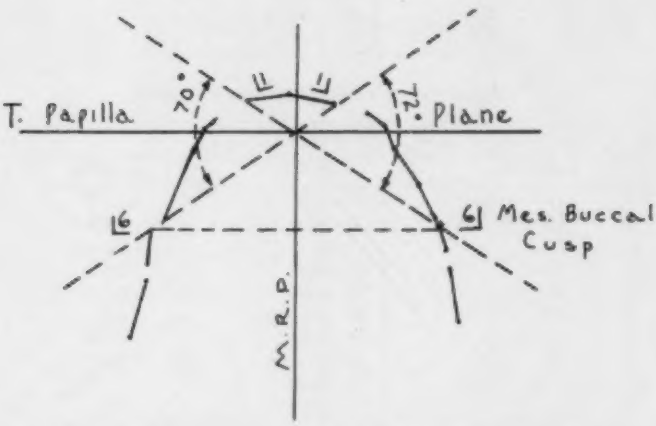


Fig. 5.—Symmetrical relationship of anterior-posterior segments.

Fig. 6.—It is essential, if a comprehensive study of comparative vertical relationships of any part to other parts of the maxilla is to be made, that the radius arm shown with its marker and vertical gauge be a mechanical projection of the horizontal papilla plane. However, vertical changes in any given part can be measured without the radius arm being a projection of the horizontal palatal plane.

to the transverse papilla and the median raphe planes; it is also a graph of symmetry relationship of (*A*) right and left molars and (*B*) right and left first incisors. The diagram (Fig. 8) interprets these graphs.

TABLE I. CASE 1. BUCCAL CUSPS

RIGHT		MM.		LEFT		
ANGLE	RADIUS	VERTICAL	TOOTH	VERTICAL	RADIUS	ANGLE
7	5	5.5	1 M. inc.	5.5	5	Plus 7
			1 D. inc.	7	8	60
73	8.5	4.5	2 M. inc.	6	9.5	62
95	13.5		2 D. inc.		13.5	83
92	14.5		3 Mes.		14.5	79
98	16.5	5.5	3 Cusp.	7	16.5	85
110	19.5		3 Dis.		19	102
116	23	5.5	4 Cusp.	6.5	22	109
124	28	5.5	5 Cusp.	7.5	28	120
130	33.5	5.5	6 M. cusp.	8.5	32.5	126
135	37.5	5	6 D. cusp.	9	36.5	129
139	44	3.5	7 M. cusp.	7	42.5	135
141	48	2.5	7 D. cusp.	5.5	46	138

TABLE II. CASE 1. LINGUAL CUSPS

RIGHT		MM.	LEFT	
VERTICAL	RADIUS	TOOTH	RADIUS	VERTICAL
5	19	4 Cusp.	18.5	5.5
1	19	4 Groove	18.5	1.5
5.5	25.5	5 Cusp.	24	6.5
1	25.5	5 Groove	24	2.5
5.5	33	6 M. cusp.	32	9
1.5	33	6 M. groove	32	4.5
5.5	37	6 D. cusp.	35.5	9
1.5	37	6 B. groove	35.5	5
4.5	43.5	7 M. cusp.	41.5	8
2	43.5	7 M. groove	41.5	5
3.5	46.5	7 D. cusp.	44.5	6
4	47.5	Heel	45.4	5.5

The vertical graph (Fig. 9) was made from the survey of the lingual cusps. This graph shows the comparative height of the right and left occlusal planes as well as the height of the clinical crowns.

The correct diagnosis of Case 1 might be: a unilateral extraversion, due to an abnormal assemblage of the halves of the maxilla; as indicated by the difference in the height of the teeth and the heels of the denture on the right and left segments, plus the effect of the early loss of the lower left first molar as indicated by the increase in the difference in the height of the planes above this area.

On the other hand, the correct diagnosis might be a unilateral intraversion, due to an insufficient interdental space; as indicated by the vertical relationship of the right second molar to the heel of the denture and the shortness of the clinical crowns. This malrelationship between the degree of intermaxillary space and the normal length of the teeth, together with the muscular control of the full-way space, inhibited the teeth on the right side from obtaining their full growth, while the loss of the lower molar permitted the upper teeth to obtain their predetermined length, which carried them below the original occlusal plane.

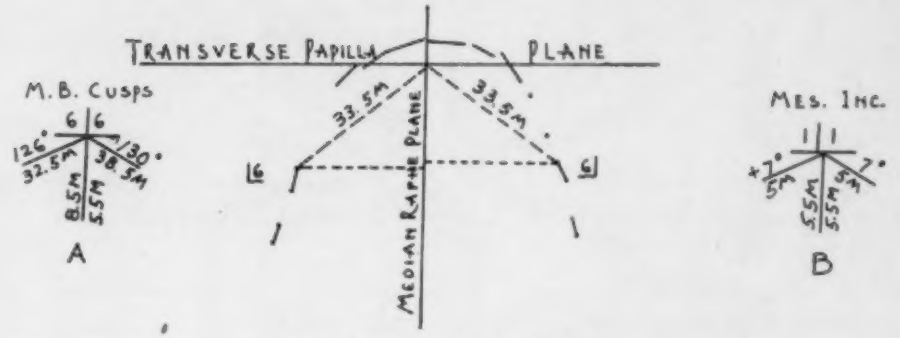


Fig. 7.—Case 1, aged 16½ years.

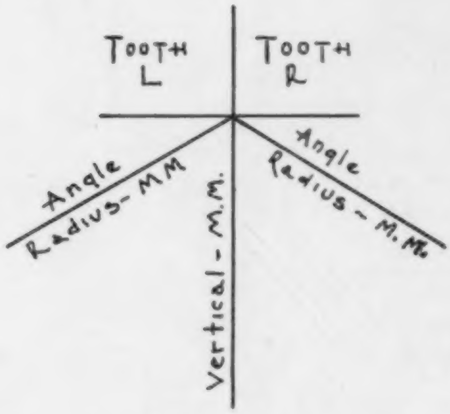


Fig. 8.—Symmetry indicator, mates of teeth.

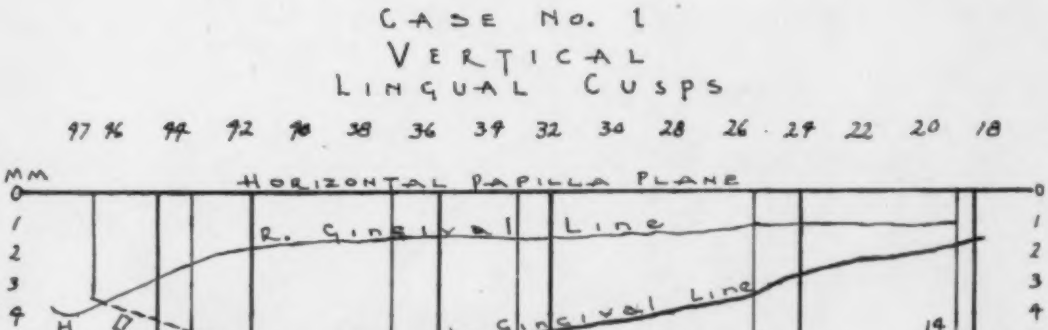


Fig. 9.

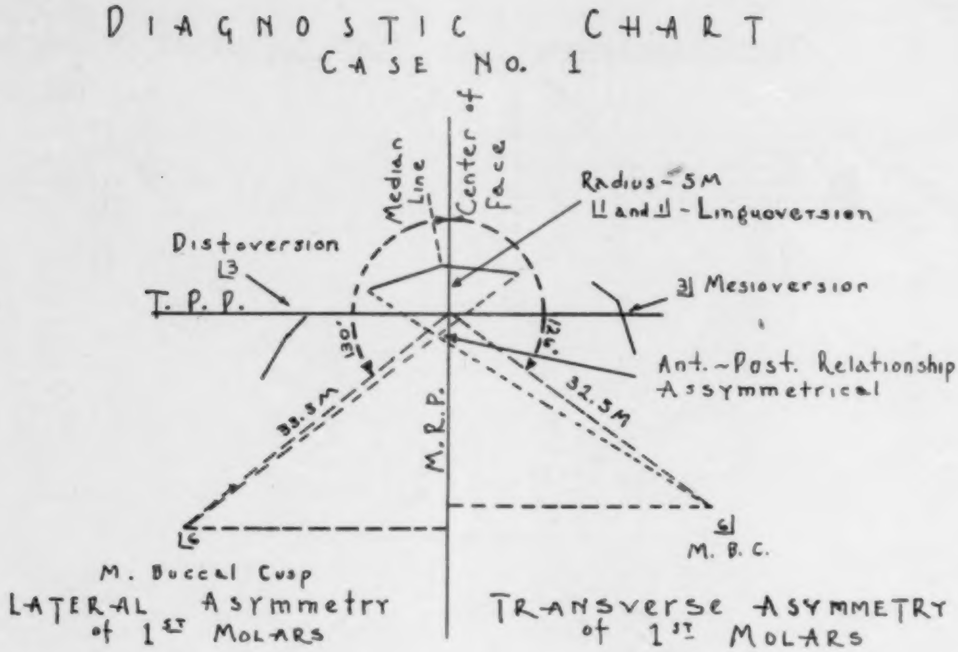

DIAGNOSTIC CHART
CASE NO. 1
Median Line
Center of Face
Radius - 5M
1|1 and 2|2 - Linguoversion
Distoversion
3|
T. P. P.
3| Mesioversion
Ant.-Post. Relationship
Assymmetrical
130°
125°
33.5M
32.5M
M.R.P.
6|
|6
M. B. C.
M. Buccal Cusp
LATERAL Asymmetry
of 1ST Molars
TRANSVERSE ASYMMETRY
of 1ST MOLARS

Fig. 10.

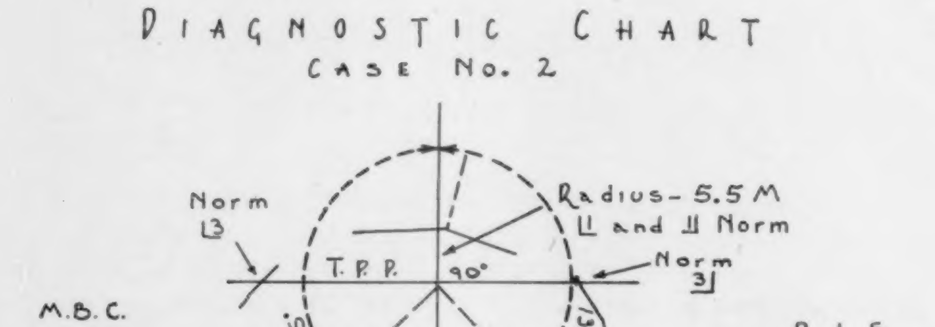

DIAGNOSTIC CHART
CASE NO. 2
Norm
3|
Radius - 5.5M
1|1 and 2|2 Norm
T. P. P.
90°
Norm
3|
M.B.C.
6 | 6
132°
135°
31.5M
33M
D I S
2 | 2
82°
15.5M
14M
135°
131°
33M
31.5M
M.R.P.
90°
M.B.C.
M.B.C.
1ST Molars Symmetrical
Lateral
1ST Molars Symmetrical
Transverse
Age 20

Fig. 11.

Thus, this change in the vertical position of the occlusal plane of the right segment was not the result of a pathologic elongation but was due to the release of inhibition to natural growth.

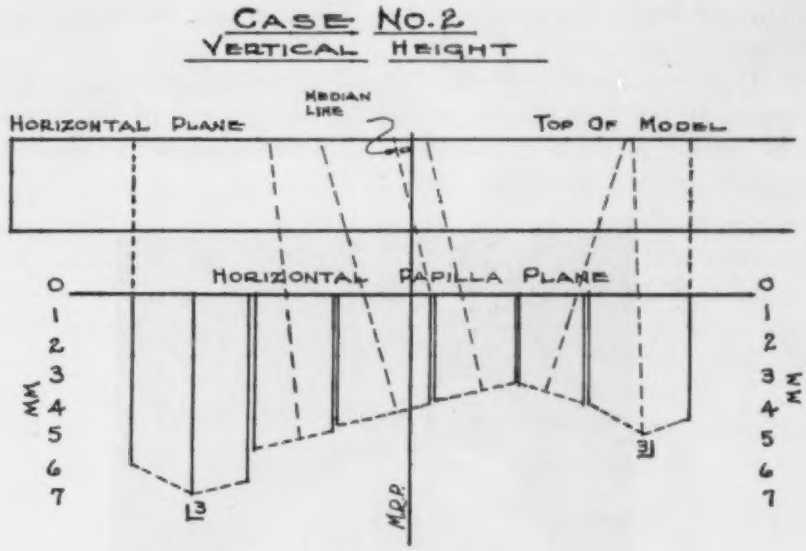


Fig. 12.

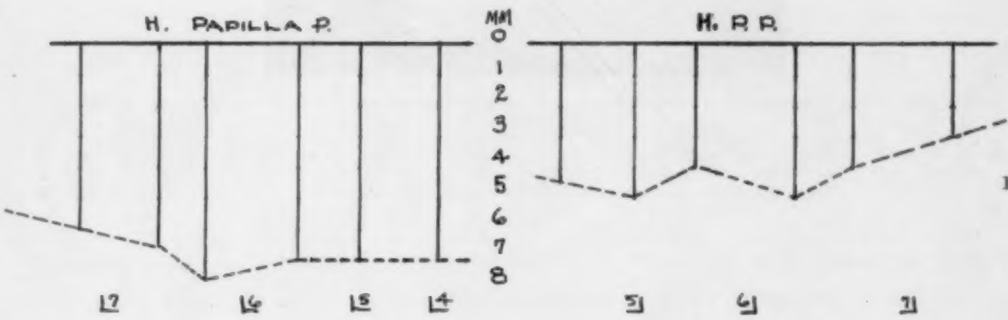


Fig. 13.

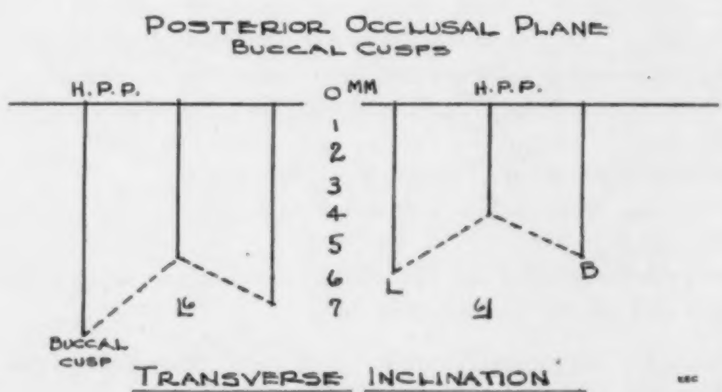


Fig. 14.

A number of asymmetrical relationships, as well as the position of the planes to those teeth of the anterior section that influence the profile, are shown on the diagnostic chart (Fig. 10).

In Case 2 (model used in Fig. 6) there is a similarity to Case 1 in the length, width, and form of the arch. They are also similar in that in both cases the height of the teeth above the horizontal papilla plane of one segment was greater than on the other. But a survey with the gnathotransit demonstrated that the symptoms in this case were not the same and, therefore, the diagnosis was different.

Fig. 11, the diagnostic chart, shows symmetrical, lateral, and transverse relationships of the first molars, a normal relationship of the cuspids to the transverse papilla plane, and a normal radius to the incisal edges of the central incisors, resulting in a normal profile.

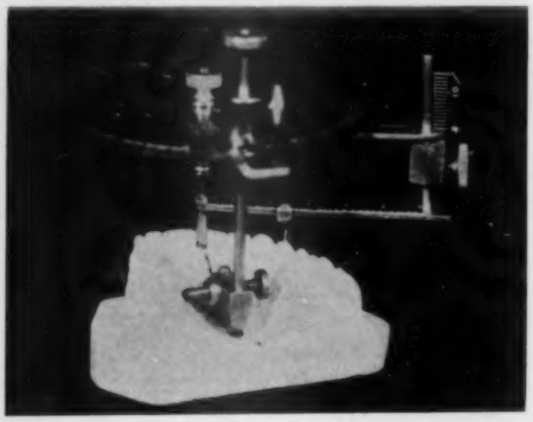


Fig. 15.—This illustration shows the radius arm with its pointer resting on the buccal cusp of the first premolar and adjusted so that it is a projection of the horizontal papilla plane. When the angle indicator points to 90°, then its perpendicular extension and the horizontal pin that is resting on the papilla establish the transverse papilla plane. The foot of the palatal pin is also shown, resting on and extending along the median raphe. The horizontal portion of this pin and that of the papilla pin are projections of the median raphe plane.

But asymmetry in the vertical height of mates of teeth was shown to exist, and on the examination of a complete survey of the vertical relationship the following symptoms were noted:

1. The height of the anterior section and posterior segment above the horizontal papilla plane was greater on the right side (Fig. 12 and 13).

2. The inclination of the long axis of the teeth from distal of left cuspid to center of right cuspid inclined toward this right side (Fig. 12).

3. Transverse inclination of palate to right side.

4. Symmetrical relationship between the length of the crowns of mates of teeth.

5. Transverse inclination of the cusps of posterior teeth. Buccal cusps longer on right and shorter on left (Fig. 14).

Diagnosis: Unilateral extraversion of normal assembled halves due to an abnormal transverse orientation of the maxilla.

Accurate remounting on the same model can be made by seating the two pins in their original positions and adjusting the palatal pin till the horizontal arms of the instruments are parallel to the top of the model, as indicated by the circular spirit level mounted in the center of the circular protractor.

Also, accurate mounting of subsequent models, during or after treatment, can be made without using the level orientator impression by: seating the instrument on the original model as described previously, after which the transverse guide for secondary model mounting is adjusted to touch one side of the palate (Figs. 2 and 15). The gnathotransit is then transferred to the secondary model, and, due to the stability of the denture areas on which it rests, the positional relationships will be reproduced.

SUMMARY

The objective of the gnathotransit method is to make a complete (including postoperative) and accurate symmetroscopic examination with less complications, as well as to make a more detailed survey of the maxilla, from which a number of dental problems can be evaluated.

The gnathotransit functions on the principle that an area can be correctly surveyed in three dimensions, with line and angle measurements from a center, by orientating the area between horizontal planes.

And that by intersecting three planes, a longitudinal, a transverse, and a horizontal, at this center, an analysis of the survey can be made in a comprehensive manner.

REFERENCES

1. McCoy, James David: Diagnosis and Treatment of Dental and Mandibular Retroversions, INT. J. ORTHODONTIA **23**: 1-22, 1937.
2. Muzj, Edmondo: The Method for Orthodontic Diagnosis Based Upon the Principles of Morphologic and Therapeutic Relativity, Angle Orthodontist **9**: 123-141, 1939.
3. Simon, Paul W.: The Necessity of Gnathostatic Diagnosis in Orthodontic Practice, J. Am. Dent. A. **15**: 22-36, 1928.
4. Weingart, M. Alden: The "Key Ridge" as a Diagnostic Aid in Orthodontics, J. Am. Dent. A. **29**: 1583-1589, 1942.
5. Hillyer, Norman L.: A Broader View of the Gnathostatic Diagnosis of Simon, J. Am. Dent. A. **17**: 430-434, 1930.
6. Lowy, Richard: Diagnosis, AM. J. ORTHODONTICS AND ORAL SURG. **24**: 762-767, 1938.
7. Adler, Peter: A Critical Account of Grunberg's Method of Symmetroscopy, D. Items Interest, pp. 434-441, May, 1948.
8. Schwarz, Rudolph: Individual Measurements of the Face and Jaws Before and During Orthodontic Treatment, Int. J. Orthodontia **19**: 22-54, 1933.
9. Lewis, Samuel J.: Some Aspects of Dental Arch Growth, J. Am. Dent. A. **23**: 277-294, 1936.
10. Huneeus, Rafael: General Practitioner Has Duty of Being on Guard for Development of Abnormalities of Occlusion in Children, Dental World, vol. 3, no. 2, 1948.
11. Harper, Robert N.: The Incisive Papilla; the Basis of a Technic to Reproduce the Positions of Key Teeth in Prosthodontia, J. D. Res. **27**: 661-668, 1948.

MASONIC TEMPLE.

AUTOKINESIS AND EXTRACTION

M. Albert Munblatt, D.D.S., New York, N. Y.

THE editorial "Autokinesis" in the November, 1948, issue of the American Journal of Orthodontics is a noble attempt to clarify an issue which is creating more and more confusion in our specialty. The present wave of extraction therapy as promulgated by Dr. Charles H. Tweed has presented a challenge to the specialty of orthodontics and the profession of dentistry. While we cannot deny the sincerity and capability of Dr. Tweed, we must realize that the bold step taken by him is fraught with danger and weakens us considerably in our defense against the recurrent innovations of expediencies in orthodontic therapy.

"Autokinesis" is a new word to cloak the same attempt to advocate the practice of extracting children's teeth for the prevention and treatment of malocclusion. This has occurred at different times since the beginning of modern orthodontics. I am reminded of a letter written by Dr. Arthur A. Libby published in the August, 1935, issue of the International Journal of Orthodontia and Dentistry for Children. At that time I was asked by Dr. Ketcham's office to write an article which was published in the December, 1935, issue of the International Journal of Orthodontia and Dentistry for Children under the title of "The Problem of Extraction in Orthodontia." It bears rereading at present. The concluding paragraph in that article was:

> The ideal normal occlusion is a goal which, though impossible to attain, is considered, on general principles, the best functional occlusion and most conducive to a healthy dentition. Although normal occlusion is found to vary considerably and congenitally missing teeth often are complications to be overcome, a full complement of teeth regardless of the malocclusion present is more favorable for orthodontic treatment than a dentition which is marred by extraction or by the congenital absence of one of its members. The orthodontic problem is a complicated one; extraction whether it be for prevention or for treatment aggravates that problem. The solution must be sought elsewhere. Short cuts of this nature hinder progress.

In view of developments since that time, I must modify that statement now. However we may oppose the practice of extraction in orthodontic therapy, we cannot deny the fact that Dr. Tweed has built a strong case in its favor. Unless we recognize that and face the issue squarely, we will never clarify the confusion existing in the specialty of orthodontics today.

Although I may surprise some and shock others, I wish to point out, as a result of considerable thought and study, that there are two men who have contributed greatly to the solution of the problem of extraction. They are Milo Hellman and Charles H. Tweed. Hellman, on the one hand, never resorted to extraction and practiced excellent orthodontics. The results of his orthodontic therapy stood up very well, and his attainments in simple as well as complicated cases were the best. He was the unique combination of a great scientist, an

excellent technician, and a clever, capable, diligent, and ultimately experienced clinician. He was therefore able to judge properly the possibilities and limitations of orthodontic therapy and was of the definite opinion that extraction is not a solution to the vexing and unsolved problems of treatment and retention. He enjoyed his work and pleased his many patients. His accumulated casts and records bear testimony to the soundness of his judgment. Because of his refusal to resort to extraction, we have an excellent record of what can be done without resorting to that compromise.

Tweed, on the other hand, also a capable technician, had the courage to go all out for extraction in orthodontic therapy. We owe him a great debt for that bold step. He seems to have attained excellent results and has created many followers. He has demonstrated what may be the possibilities of extraction in orthodontic therapy. I have tried earnestly to reconcile the diametrically opposite viewpoints of these two men, and I have come to certain conclusions as a result of some experiments in orthodontic therapy during the last two or three years. I shall present them at the opportune time, but I cannot refrain from making the observation at present that a reconciliation of these two opposite viewpoints is not only possible but necessary for the benefit of our specialty.

An excellent paper entitled "Principles Involving Extraction in the Successful Treatment of Cleft Palate Conditions" by Dr. Joseph D. Eby was presented at the November, 1948, meeting of the Northeastern Society of Orthodontists. This paper offers the focal point from which the desired reconciliation can emanate. The practice of extraction judiciously done in orthodontic therapy has been demonstrated to be a beneficial and sometimes necessary compromise. The greatest harm done to the policy of extraction is the methods by which the attempt is made to prove it scientifically correct. By employing such methods we undermine the scientific foundations of our specialty. The only principles that can be evolved to guide us in the choice of when, which, and how many teeth should be sacrificed must come from clinical observations and experiments. Dr. Eby's paper is an example of such an attempt.

As for the newly coined procedure of so-called "autokinesis," I believe that the idea can only result from a misleading observation of a novice in orthodontic experience and knowledge. There may be cases where the mere extraction of a tooth will make room for the eruption of a neighboring tooth in its place, but usually it needs some appliance manipulation to bring the erupting tooth into good alignment for esthetics and proper function. To practice such a procedure of extraction in a developing dentition is interfering with growth of the jaws and the development of that dentition. Extraction of any kind, whether for prevention or treatment, should be used judiciously, sparingly, and with a good understanding of the consequences that may follow.

57 WEST 57TH STREET.

A BASIS AND METHOD OF ORTHODONTICS

John Heath, L.D.S., R.C.S. (Eng.), Melbourne, Australia

ORTHODONTICS would be practiced by more dentists, particularly in remote districts, if a reasonably stable result could be assured. The present orthodontic teaching does not allow a reasonable result to be predicted.

Past teaching has failed in this respect because:

A. It has been incorrect. Brodie[1] and others have disproved the teaching of Angle.

B. Apparatus has been inefficient, difficult to manage, and dangerous in inexpert hands.

C. There has been no fixed basis of treatment planning.[2] The student learned, quite correctly, the large number of relevant facts and theories which constitute the essential background of orthodontic teaching. He also learned to fit and handle orthodontic apparatus. But although plenty of material existed for studying why the treatment adopted would end in a satisfactory result, in each case the "floating basis" made this prediction of result too difficult to teach over a wide enough series of cases of give the student sufficient experience to practice orthodontics.

THE USUAL AND THE ABNORMAL CASE OF MALOCCLUSION OF THE TEETH

As the primitive face has evolved from the edge-to-edge bite of the prognathous face, to the face of today with malocclusion, variation took place in a certain order.[3]

Crowding of mandibular incisors and impacted mandibular third molars was found. The edge-to-edge incisal bite changed to overbite and overjet of anterior teeth, and the anterior maxillary teeth became crowded, or leaned labially and spaced.

Finally, the mandible, carrying the mandibular arch, was found in a position in which the mandibular arch was one whole cusp distally to its maxillary opponent in "distoclusion" (Class II, Division 1 malocclusion).[4]

The most common complications which upset the balance of the arch follow either (a) premature loss of deciduous molars, or (b) loss of first permanent molars.

When maxillary deciduous molars are lost prematurely, the most common consequence is mesial migration by one cusp or more of the maxillary first permanent molars, and increase of incisal overbite.

When mandibular deciduous molars are lost prematurely, the mandibular first permanent molars usually lean mesially, with a little mesial migration, but the anterior mandibular teeth fail to develop as far labially as they would have done. This results in increase of incisal overbite (Fig. 1).

When first permanent molars are lost and no treatment is undertaken, the resultant migration and variation of growth are shown (Fig. 2).

These are the usual cases of malocclusion. Most cases are in this category. The student can and should be taught to recognize these cases and to differentiate them from others in which potentially subtle etiological factors may be involved. Or he may be trained to refer his cases to a consultant for advice before treating them himself.

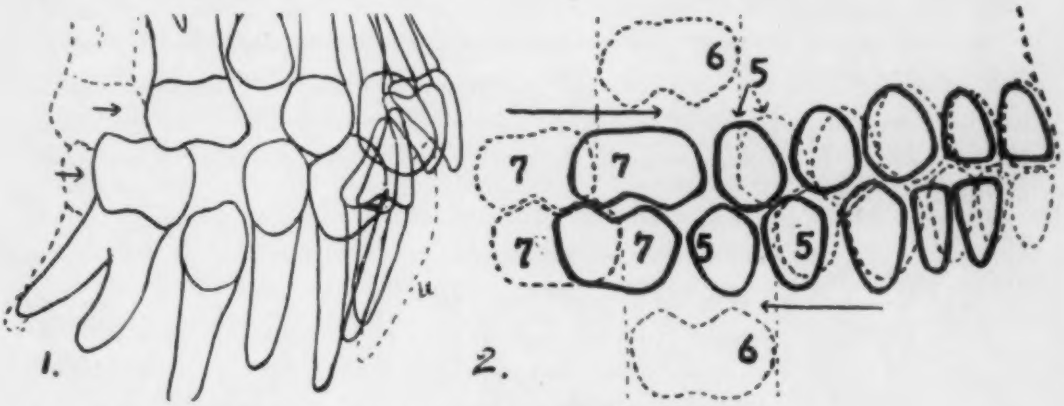


Fig. 1.—The results of premature loss of deciduous molars.
Fig. 2.—The results of loss of first permanent molars.

Herewith are described methods of deciding what may be done with these *usual* cases of malocclusion.

There are *known facts* upon which treatment may be based, about which there appears to be no dispute in orthodontic literature.

1. *The growth plan of the face is established very early in life.*[1]

2. *The basal bone of the face is not, but the alveolar bone is, capable of alteration by orthodontic treatment.*[1]

3. *The mandibular dental arch is at any moment of time "balanced" where it is found or is unbalanced and is moving to a balanced position.*[4] *It is known that if the mandibular arch be moved far from where it is found, or where it would have been but for extraction, it tends to relapse toward its former position.*

4. *There is an "extrusive" force tending to move the posterior maxillary teeth mesially.*[4] *If they move or are moved mesially one cusp, they are "balanced" and tend to remain in a stable relation. If they are moved distally, they tend to move mesially again. The pterygomaxillary fossa position is not altered by orthodontic treatment.*

THE EVOLUTIONARY AND PERSONAL BACKGROUND OF MANDIBULAR ARCH POSITION

The whole evolutionary background of the individual—his family, his racial ancestry, and every conditioning factor capable of modifying him morphologically—is represented in the position of the mandibular arch. Students of orthodontic literature will have been amused or bewildered by the various theories recently advanced, each with a different mathematical basis, as to where the mandibular incisors should be positioned.[5, 7]

But natural forces have established pretty nearly where the mandibular arch must remain, and the further it is removed from this position the greater usually will be the risk of relapse. Biometrically the mandible is a most variable bone.[6]

So the mandibular dental arch is here established as a basis of orthodontic treatment planning.[4] However, if a tooth be extracted from a mandibular arch, the remaining near-by teeth usually lean lingually and the arch decreases.

EXAMINATION OF THE ORDINARY CHILD'S MANDIBULAR ARCH

After the child has been seen and the parent or guardian questioned, and it has been established that it is an ordinary child with ordinary malocclusion, ***the next step is to examine visually the child's mandibular dental arch and x-ray pictures thereof.***

THE THREE CHIEF STATES OF THE MANDIBULAR ARCH

(a) Either it is a suitable or perfect arcade.
(b) Or there is ***slight*** crowding, which may be permanently rectified.
(c) Or there is or will be so much crowding that extraction is essential to correct the tooth-bone ratio, if the arch is to remain stable.

(a) *The Suitable or Perfect Mandibular Arch.*—This, by itself, needs no treatment. However, it may have to be used as an anchorage for traction for intermaxillary force, in which case it may be moved from its "balanced" position, and tend to return thereto later.

When this is an alternative to using headcap and occipital anchorage at night, the latter alternative is rarely favored on account of its tendency to upset the child's sleep, and the balance of his personality.

(b) ***There Is Slight Crowding.***—In such cases, the arch may be enlarged and remain stable even when the third molars erupt. The writer knows of no facts upon which impaction of mandibular third molars may be anticipated.

(c) ***Extraction to Correct Tooth-Bone Ratio in Very Great Crowding.***—(In this class there is included, for convenience, those cases in which first permanent molars must be extracted following caries.) ***Each dentist may place his own interpretation upon what he decides is very great crowding. This may depend upon how much effort and time are to be consumed in treatment and retention.***

The author desires to minimize these two factors. He previously advocated and practiced the extraction of $\overline{4|4}$ (and $\underline{4|4}$) as is now common practice in the United States.[5,7]

When $\overline{4|4}$ are extracted, the teeth posterior to the space not only do not move mesially further than $\frac{1}{16}$ inch themselves, but it also takes a long time to move them mesially. This is shown by serial lateral x-ray pictures of the face.

Therefore, if the $\overline{4|4}$ space is closed, it is chiefly due to great lingual movements of the anterior six mandibular teeth. In addition, it leads to increase in overbite of the anterior teeth, which is frequently already a source of trouble.

THE THREE ALTERNATIVES

I. *Extraction of a Mandibular Incisor.*—Crowding in the mandibular incisor region is the most common variation in occlusion, and it is here that crowding first commenced in primitive people.[3, 4] Cases of twenty years' standing show that the ultimate result of extracting a mandibular incisor has proved more uniformly satisfactory than extraction of 4 | 4.[8]

If extraction of a mandibular incisor is done too early, the space may close leaving the remaining teeth still crowded.[9] It may be wise temporarily to disregard crowding here while other treatment is proceeding and extract an incisor in the "teen" ages.[9] The most nearly parallel roots of the remaining incisors usually follow the extraction of the most vertical one.

II. *The Extraction of Second Mandibular Premolars.*—When there is great crowding in this region, either due to premature loss of many deciduous teeth, or due to quantitative malrelation of tooth and bone, these teeth may be extracted.

III. *Extraction of Mandibular First Premanent Molars.*—This follows extensive caries, and is *deferred until premolars are in occlusion.* Usually the maxillary first permanent molars are also extracted, and arches fitted to both dentures with intermaxillary force in which 54321 | 12345 are opposed to 7 | 7 to move the latter mesially to close the 6 | 6 space.[4] These are usually "poor-risk" mouths, and after this treatment the denture has a greatly enhanced chance of survival as an entity. This treatment is highly recommended by the writer who has seen its results over many years.

THE EXTRUSIVE FORCE TENDING TO MOVE THE POSTERIOR MAXILLARY TEETH MESIALLY[4]

Moving posterior maxillary teeth distally has been one of the greatest factors in relapse after orthodontic treatment. *They have been intruded to the face beyond the architectural capacity of the bone to support and "balance."*[1]

It is known that when a maxillary side tooth is extracted, the teeth distal to the gap tend to move mesially and remain balanced in this position.

THE EXTRUSIVE FORCE EXPENDS ITSELF

So in Class I cases the posterior maxillary teeth may be balanced by moving them or allowing them to move mesially one cusp. To allow this, either 4 | 4 or 5 | 5 or 6 | 6 may be extracted to allow the extrusive force to expend itself.[4] In Class II cases the best teeth to extract are 6 | 6, although 5 | 5 and 4 | 4 are very commonly extracted.

By this plan the whole mandibular arch and the posterior maxillary teeth are positioned as nearly as possible to where they are naturally "balanced" within the muscular and osseous framework of the face.

THE ANTERIOR MAXILLARY TEETH

We are left to decide how to move all the anterior 6, 8, or 10 teeth in the maxilla to function and occlude with their opponents, and, very frequently, to correct an overbite. This is chiefly a technical matter requiring no special knowledge.

(To simplify this thesis, Class III cases and other unusual or extreme variations are being mentally referred to those experienced in the pitfalls inherent in their treatment.)

THE USE OF HIGH TENSILE STRENGTH, RESILIENT, AND FLEXIBLE ARCH WIRES IN ORTHODONTIC TOOTH MOVEMENT

The aim of orthodontics is to move teeth from undesirable positions to new positions within the face which, when all relevant facts be considered, contribute best to the survival and enhancement of life of the individual.

Six main types of tooth movement are considered here, which are effected with resilient and flexible wires applied to teeth with bands, cleats, and tubes:

1. Movement of a tooth out of the arch to its place in it.
2. Enlargement of the arch in which the teeth are crowded.
3. Decrease in the arch because it is too large or because a tooth or teeth have been extracted from it.
4. Alteration of the whole arch in the three dimensions.
5. Movement of whole or part of an arch in order to relate it to its opponent.
6. Axial rotation of teeth.

Resilient and flexible arch wires which at the moment effect most satisfactorily any one of these movements do not necessarily perform simultaneously any or all of the others—hence such widely different apparatus as the edgewise arch, the Atkinson arch, the Johnson twin arch, and the "multiple-wire" arch. None of these covers the whole keyboard of forces, acceptable to the tissues, with minimum expenditure of office time.

The ideal arch might simultaneously perform all requisite tooth movements, conserving best the immediate and ultimate health of all tissues, and expending the minimum amount of the operator's time.

The writer suggests that his armamentarium makes it possible to use the best forces available at the best time, all facts being considered. He bases treatment upon monthly visits by children near at hand, and six times a year by children who travel great distances.

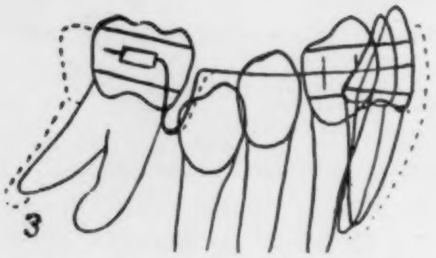
In discussion of apparatus and tooth movement, four degrees of crowding and axial rotation will be described: (a) slight, (b) considerable, (c) great, and (d) very great.

HIGH TENSILE STAINLESS STEEL ARCH WIRES AND THEIR USES

Most of the needs of orthodontics are met with three main stainless steel arch wires. These cover the whole keyboard of necessary forces, acceptable to the tissues, with minimum expenditure of office time and cost.

1. A 0.022 inch square high tensile wire.
2. A 0.015 inch super high tensile strength wire, or the same rolled and/or doubled.
3. A "multiple-wire" arch of 3 or 4 round high tensile strength wires of 0.009 inch.[4]

I. *0.022 inch square is used for:*
(a) Increasing size of arch with *slight crowding.*
(b) Slight alignment of single tooth to arch.
(c) Slight axial rotation of tooth or teeth.
(d) Root movement with second order bends.
(e) Root movement with torque force.
(f) Final slight alignment after use of finer wire.
(g) Correction of curve of Spee.
(h) Retention of arch in desired form.
II. *0.022 inch square with U bend:*
(a) Slight enlargement of whole arch by opening U bend (Fig. 3).
(b) Slight enlargement of space for single teeth by opening U bend.
(c) Same functions as I a-h.
III. *0.022 inch square with loops and rubbers in same arch:*
(a) Closing up spaced teeth.
(b) Closing up space after extraction (Fig. 4).
(c) Moving $\underline{321 \mid 123}$ distally to correct overjet (Fig. 5, *A*, *B*, and *C*).
(d) Moving $\overline{321 \mid 123}$ distally to correct overbite (Figs. 6 and 7).
(e) Moving $\underline{65 \mid 56}$ mesially one cusp to "balance" (Fig. 8, *A* and *B*).
(f) Moving $\underline{7 \mid 7}$ mesially and upright after extraction of $\underline{6 \mid 6}$.
(g) Moving $\overline{7 \mid 7}$ mesially and upright after extraction of $\overline{6 \mid 6}$.
(h) Moving $\underline{321 \mid 123}$ distally after extraction of $\underline{4 \mid 4}$.
IV. *0.022 inch square with loops and rubbers, with intermaxillary force:*
(a) Moving anterior maxillary 6, 8, or 10 teeth dorsally.
(b) Moving $\underline{65 \mid 56}$ mesially one cusp to "balance."
(c) Moving $\overline{7 \mid 7}$ mesially upright, and $\underline{54321 \mid 12345}$ dorsally after extraction of $\frac{6 \mid 6}{6 \mid 6}$.
V. *0.022 inch square with U and loops:*
(a) Intermaxillary force with slight enlargement of arch.
(b) Intermaxillary force holding present size of arch.
VI. *0.022 inch with "double-sized" tube:*
(a) Increasing space in the arch for general crowding (Fig. 10, *A*).
(b) Making room for $\overline{54 \mid 45}$ or $\overline{5 \mid 5}$ after premature extraction of $\overline{Ed \mid dE}$, $\overline{6 \mid 6}$ have migrated a little and leaned mesially, and permanent incisors have not developed fully the normal distance labially (Fig. 10, *B*).
VII. *0.015 inch round high tensile strength arch wire, single:*
(a) Increasing size of arch with *considerable* crowding.
(b) Final aligning of teeth, in some cases.
(c) *Considerable* aligning to arch of single teeth.
(d) *Considerable* axial rotation of teeth.
(e) Root movement with second order bends.
(f) Application of torque force using narrow U bend at cleat.
VIII. *0.015 inch round high tensile strength arch wire, doubled:*
Widening a narrow arch, particularly narrow maxillary arches in which the buccal cusps of maxillary molars are biting into the sulcus of the mandibular



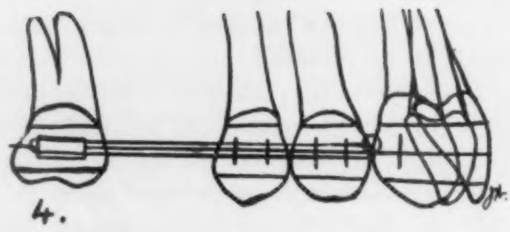


Fig. 3.—Arch wire with U bend to enlarge arch and loop for rubber.
Fig. 4.—Method of closing up space with rubber and loop in arch wire.

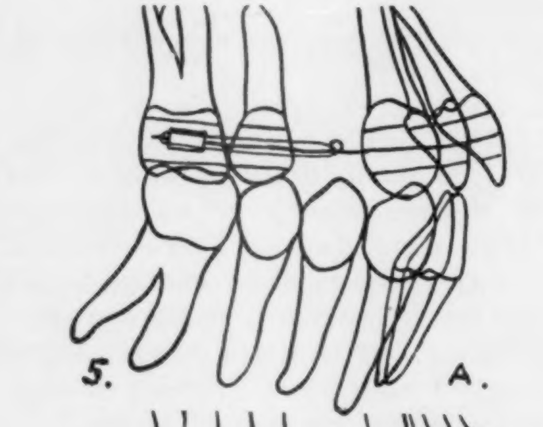
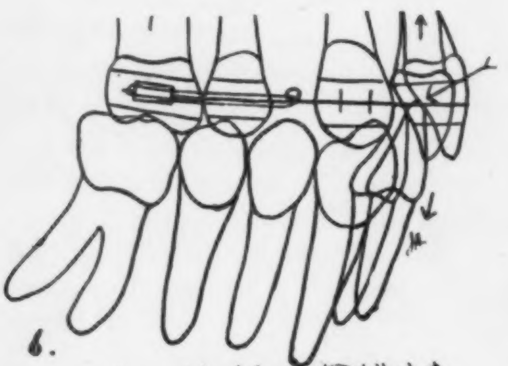
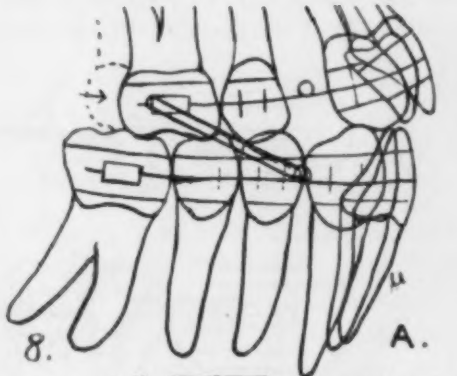


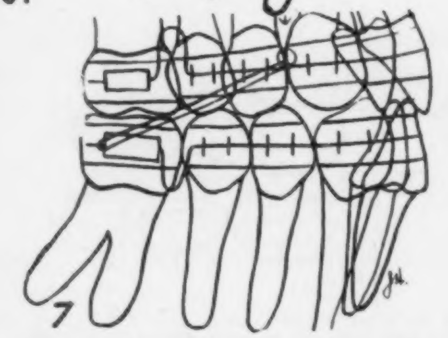
Fig. 5.—*A*, *B*, and *C*, Method of moving 321 | 123 distally to correct overjet.

molars. *The double 0.015 inch arch is much more effective for this tooth movement than an edgewise arch.*

If there be crowding or axial rotation of anterior teeth, this may be rectified concurrently with widening of narrow arch by using only one of the 0.015 inch wires to move the crowded or rotated teeth into line. In special cases one of the 0.015 inch wires may be rolled to 0.009 inch in the region of the anterior teeth.







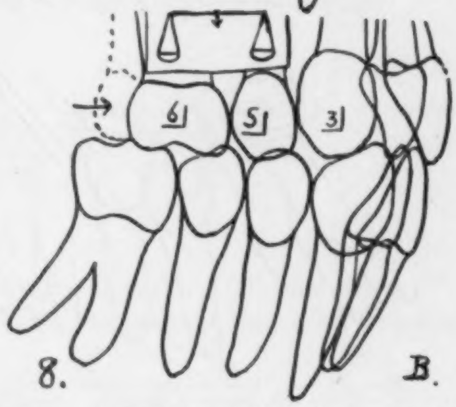


Fig. 6.—Method of correcting overbite with rubbers. If posterior teeth tend to move too far mesially, intermaxillary force is applied as in Fig. 7.

Fig. 7.—Correction of overbite using intermaxillary force with no extraction.

Fig. 8.—*A*, Moving posterior maxillary mesially to "balanced." *B*, Posterior maxillary teeth in "balanced" position.

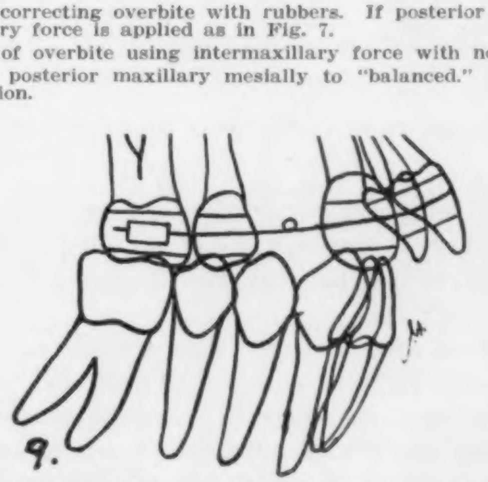
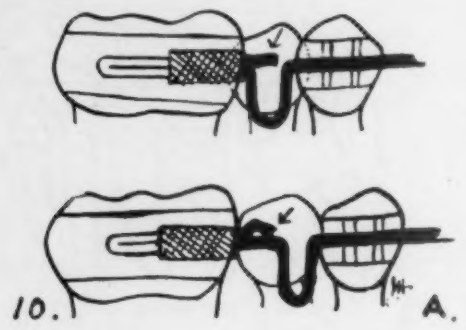


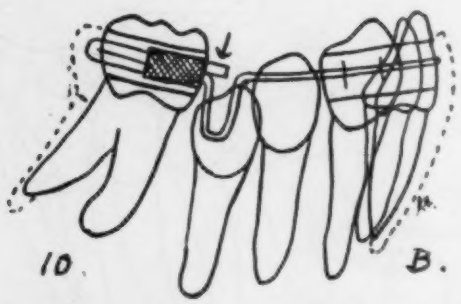
Fig. 9.—In attempt to withdraw 321 | 123 distally to close 4 | 4 space, posterior teeth have moved mesially. Intermaxillary force is necessary as in Fig. 5*C*.

IX. *0.015 inch round high tensile strength arch wire doubled with loops for rubbers:*

This is used doubled instead of the 0.022 inch square wire edgewise arch when widening the posterior part of the arch is needed in conjunction with any of the tooth movements for which the 0.022 inch square arch with loop is used.

One of the 0.015 inch wires may be used for aligning crowded anterior teeth concurrently with other tooth movements. The loop for rubbers is ***bent in one only*** of the double 0.015 inch wires.





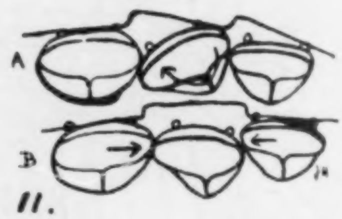


Fig. 10.—*A*, Double-sized molar tube 0.044 inch by 0.022 inch. The 0.022 inch arch wire is softened in flame. Arch is drawn mesially and bent to prevent distal movement. In Heath, John: J. Am. Dent. A., 1948. *B*, Use of double-sized tube to correct tooth position after premature loss of deciduous molars.

Fig. 11.—Bends in 0.015 inch high tensile arch wire to obtain full value of the wire's flexibility using double-tie arch cleats.

X. *0.015 inch round super high tensile single arch wire rolled to .010 inch ribbon:*

This arch is used when *considerable* to *great* crowding of teeth exists. (Old rolling mills are used, as this wire will damage mills.) While this arch exerts less force than a 0.015 inch round wire, it will recover further from a bend and frequently move teeth further.

The last three arch wires serve the same purpose as the Atkinson or Johnson twin arches, in aligning teeth, except that when they have lost their effective force, the tooth movement still necessary may be performed by bending the arch as shown in Fig. 11, or with a 0.022 inch square arch wire or a doubled 0.015 inch arch wire. (A bent wire exerts half its full force after springing back half its distance of recovery.)

XI. *0.015 inch round high tensile strength wire rolled to 0.006 inch doubled:*

This arch extends further the range that the arch can move crowded teeth. *The distal ends of the last two arches may be soldered with gold or silver solder and bent to be used with the "double-sized" tube.* Small tubes with soldered hooks may be slid along these doubled arches. A small bend will hold tube in place.

XII. *0.015 inch arch high tensile strength doubled in the region of the side teeth and single or rolled in the region of anterior teeth:*

This arch is used quite frequently. Small tubes are used to hold the two arches together.

XIII. *The "multiple-wire" arch of 3 or 4 round high tensile wires 0.009 inch:*[4]

The "multiple-wire" arch is used when there is very great malalignment of teeth, either in *extreme crowding* or *very great axial rotation,* or *delayed eruption of one incisor.* With monthly tightenings this arch will frequently perform one-half to two-thirds of the necessary alignment in two to three months. It may be left longer on children coming from great distances or in special cases.

Usually it is replaced by a 0.015 inch or a 0.022 inch arch to complete the tooth movement. I previously used a "multiple-wire" arch of 15 wires 0.006 inch, but have had developed a high tensile 0.009 inch wire which will recover from a bend further than the 0.006 inch wire.

Helical spring:

(a) Making room for individual teeth.

(b) Making room for crowded mandibular incisors. (It is legitimate to extract deciduous mandibular canines only when subsequent treatment or retention of space is contemplated.)

Inclined planes:

Cast in silver, these are commonly used on mandibular anterior teeth when maxillary incisors are locked lingually to their opponents. They are worn one or two months.

Double-tie arch brackets:

These are made in two spacings 1/8 inch and 1/16 inch for wider or narrower teeth. *They greatly facilitate or prevent axial rotation of teeth.*

The ligature channels are 0.022 inch by 0.030 inch, and the brackets are made of 0.048 inch round wire. The arch channel is 0.015 inch by 0.030 inch, and may be widened to 0.022 inch with a diamond cutter.

Retaining plates, static and working:

Static retaining plates are made of acrylic resin and stainless steel wires. They may have inclined planes on which anterior mandibular teeth bite, *either partly to correct overbite before treatment* or to hold correction after treatment. *In each case the child must be told to tighten the arch wire against the labial surface of the anterior teeth each time the plate is worn.*

The anterior edge of the plate against the incisors and canines may be filed to clear a little. Working retaining plates in cast aluminum are of value in special cases. They have a jackscrew either for widening the arch or to make room for a canine in cases of partial relapse.

HIGHER TENSILE STRENGTH WITHOUT BRITTLENES IN ARCH WIRES

The only partly resolved problem of tooth movement with minimum effort would be further resolved to a great degree if an alloy could be developed which had double or treble the present tensile strength without brittleness. (Present stainless steel wires seem to have reached their limit at a little over 500,000 pounds per square inch.) This would make available all the necessary forces with much finer arch wires, which would have relatively much greater flexibility and resiliency. Present 0.015 inch round wires recover from a bend about twice as far, and 0.009 inch round wires about three times as far as 0.022 inch square wire.

The degree an orthodontic wire will bend without taking a permanent "set" or bend is of little importance compared with the maximum distance it will move a tooth although permanently bent to some degree in the process.

Perhaps the possibilities in these directions have not been fully visualized. High level metallurgists to a great degree hold the key to orthodontic treatment for a much wider social range of children. The problem is worthy of their earnest attention.

REFERENCES

1. Brodie, A. G., Downs, W. B., Goldstein, A., and Myer, E.: Angle Orthodontist **8:** 261-351, 1938.
   Brodie, A. G.: Some Recent Observations on the Growth of the Face and Their Implications to the Orthodontist, AM. J. ORTHODONTICS AND ORAL SURG. **26:** 741-757, 1940.
2. Salzmann, J. A.: Principles of Orthodontics, Philadelphia, 1943, J. B. Lippincott Company, pp. 386-442.
3. Hellman, Milo: Fundamental Principles and Expedient Compromises in Orthodontic Procedures, AM. J. ORTHODONTICS AND ORAL SURG. **30:** 429-436, 1944.
4. Heath, John: Normal and Abnormal Occlusion of the Teeth of Australian Aboriginal Children, Australian J. Dent. **51:** 85-95, 1947.
   Simplified Orthodontics, Melbourne, 1945, W. Ramsay Pty., Ltd.
5. Sved, A.: A Further Study of Tweed's Basic Principles and the Reduction of Bimaxillary Protrusion Without Extraction, AM. J. ORTHODONTICS AND ORAL SURG. **33:** 363-387, 1947.
6. Morant, G. M.: A Study of the Human Mandible, Biometrika **28:** 84, 1936.
7. Tweed, C. H.: Indications for the Extraction of Teeth in Orthodontic Procedure, AM. J. ORTHODONTICS AND ORAL SURG. **30:** 405-428, 1944.
8. Colyer, J. F., and Sprawson, E.: Dental Surgery and Pathology, ed. 7, London, 1938, Longmans Green & Co.
9. Waugh, L. M.: The Advisability of Extraction as a Therapeutic Aid in Orthodontics: Negative, AM. J. ORTHODONTICS AND ORAL SURG. **33:** 153-160, 1947.

5, COLLINS STREET.

CHANGES IN TOOTH AND BONE TISSUE PRODUCED BY PLACING CAPS UPON THE INCISORS OF RODENTS

Viktors Kalninš, M.D., L.D.S.,* and Anna Berzinš-Raimonds, L.D.S.,*
Upsala, Sweden

I.

THIS experiment deals with the influence which an artificial force may produce upon the tissue of continuously growing and erupting teeth of rodents. Until today histologic evidence of the influence of the orthodontic force on the developing teeth has been published in connection with experiments made on dogs and monkeys. The teeth of these animals are, contrary to those of rodents, of limited growth.

Johnson, Appleton, and Rittershofer were the first researchers who described changes produced by orthodontic measures during the development of teeth. Their experiment was carried out on the developing permanent maxillary incisors of monkeys. Apart from bone findings similar to those described by Oppenheim, the authors reported that the deformation at the apical end of the tooth had taken place as a result of a movement by the force of the appliance. These changes did not occur in the control tooth of the same animal. Also, Gottlieb and Orban succeeded in producing such a deformity by creating a heavy occlusal stress at the time of root development in the molars of a dog. They stated that the ligation of the lower cuspids to a labial arch wire causes the folding and compression of the young dentine and Hertwig's sheaths. The same investigators, in collaboration with Kronfeld, observed, moreover, that the apex of developing molars of the dog, exposed to an artificial extensive force, was shortened and blunted. Ota was able to demonstrate changes in tooth-forming cells caused by the extensive orthodontic force. In this experiment the pin and tube appliance was set upon the incisors of young monkeys. Histologic examination of the jaws showed degenerative changes of the odontoblasts, followed by insufficient formation of dentine, development of the enamel drops, and activation of the epithelial clusters and that of the enamel cells on the side of pressure. Breitner investigated in monkeys the influence that the moving of the deciduous teeth has on the permanent successors. The labial arch, the lingual extension wire, and the transversal screw over the palate were used as appliances. From his experiment the author gathered that the orthodontic movement of teeth of the deciduous or mixed dentition produces a migration of the underlying and adjoining tooth germs. This is made possible by resorption and deposition of the surrounding bone.

To our knowledge, the experimental evidence of the effect of caps placed on permanently growing teeth of rodents has been mentioned only by Schour and Massler. They reported that the placing of high crowns upon the rodents' incisors produced traumatic occlusion resulting in a marked retardation and the cessation of the eruption. No histologic examination of teeth or of the alveolar bone was mentioned by them.

In the course of his former studies about the influence of vitamins and hormones upon the teeth and the bone of rodents, one of us (Kalninš) made

From the Department of Therapeutic Stomatology of the University of Latvia. Formerly Chief Associate Professor V. Kalninš, M.D., L.D.S.

*Department of Pharmacology, University of Upsala.

the observation that in guinea pigs and rabbits, which during two or three weeks had been receiving various preparations by means of stomachal feeding with the catheter, resorptions of cement and dentine (Fig. 1) as well as disturbances of the developing enamel (Fig. 2), sometimes occurred. Such injuries were not present in the molars of the same animals and in the incisors of other guinea pigs and rabbits which had been treated with the same preparations per os or parenterally. The reason for these changes was apparently the forced opening of the mouth with the wooden catch, through which the catheter was being introduced. It is obvious that during these manipulations the incisors were subjected to severe pressure and stress. These observations led us to the idea to investigate roentgenographically and histologically the changes in the teeth and the alveolar bone which would result in the placing of metal caps upon the incisors of guinea pigs and rabbits.*

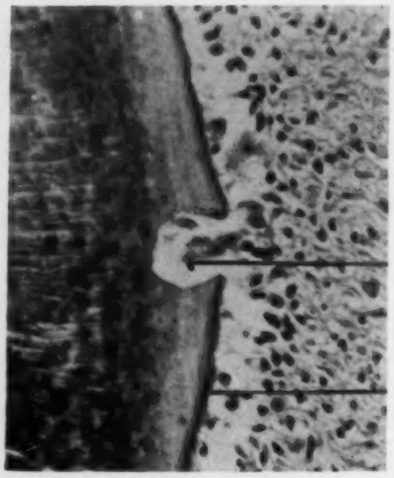


Fig. 1.

Fig. 2.

Fig. 1.—Resorption of cement and dentine due to the overstress of the tooth, performed by forcing open the mouth with a wooden catch. Area from a cross section at the lower incisor by guinea pigs which every day during the 3 weeks were receiving a solution of ascorbic acid by means of the catheter. (Kalninš.)

Fig. 2.—Developmental disturbance of enamel, due to the overstress of the incisor, performed by forced opening of the mouth by means of the catheter. Elevation and detachment of ameloblasts. "Abortive" formation of enamel matrix. An area from the middle part of the longitudinal section of the tooth of a guinea pig which during two weeks every day was receiving a solution of ascorbic acid by means of the catheter. Longitudinal section of the apical third of an incisor. (Kalninš.)

---

*The investigation was performed in 1940 and 1941. As, owing to the events of war, the material collected from the experiment with rabbits had been entirely lost, only a few preserved microphotographs and the protocols of the experiment on guinea pigs could be used for this publication. It should be mentioned that both methods and results of the experiments were the same for either kind of animals. For the same reasons it was not possible to show the roentgenograms, but, on the whole, they were similar to those published with the investigations by Schour and van Dyke and by Becks, Collins, Simpson, and Evans[1] on hypophysectomy in rats.

II.

Methods of Investigation.—Eleven adult guinea pigs with a body weight of 500 to 650 grams were used. Since the Marshall investigation has shown that the quality of the diet has an influence upon the changes caused by the orthodontic treatment, our animals received adequate food (hay, oats and green fresh cabbage ad libitum) and were kept in a sunny room. After 4 weeks the histologic examination of three start control guinea pigs showed that the bone (costrochondral junction and jawbone) and the teeth had a normal structure. In the remaining animals the edges of the upper and lower incisors were ground off, and then for each couple of teeth a special impression tray was made.

Fig. 3.—The head of a guinea pig after placing caps upon the crowns of its incisors.

The impression was made with impression compound, and the caps of randolph metal. The caps were soldered together and then cemented upon the upper and lower incisors simultaneously (Fig. 3). The survival period was 17, 50 (2 animals), 103, 135, and 143 (3 animals) days. The heads of the animals were severed immediately after death, and upon removal of the caps the jaws were roentgenographed and then fixed in a 10 per cent formalin solution. The decalcification was performed in a 5 per cent solution of nitric acid, and for the embedding celloidin was used. The upper incisors were examined by means of longitudinal sections, and the lower incisors were cut after the Westin method. Hematoxylin and eosin stain was used.

III.

Results.—Immediately after the placing of the caps the crowns of the incisor teeth became longer than normally. The length of the crowns of the upper incisors was 8.5-11.5 and that of the lower incisors was 11-14.5 mm. At the final stage of the experiment, i.e., after 103-143 days, the upper crowns reached a

length of 10-14 mm. and the lower crowns that of 17-19 mm. Thus, the average of the elongation for the upper incisors was 4-5 mm. and that for the lower ones, 4.5-6.5 mm. In the course of the experiment the occlusal surface of caps was often worn off. It sometimes happened that either the caps of the upper incisors fell off or the very teeth broke off. In no one of the animals the elongation of molars with a subsequent bite raising could be stated. This phenomenon may be explained by the roentgenologically observed distal retraction of the mandible.

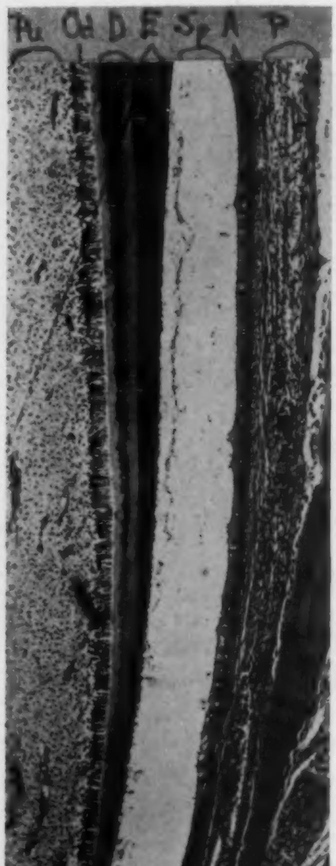


Fig. 4.

Fig. 5.

Fig. 4.—The apical end of the lower incisor of a normal guinea pig. Longitudinal section. *Pu*, Pulp; *Od*, odontoblasts; *D*, dentine; *E*, enamel matrix; *Sp*, artificial space; *A*, ameloblasts; *P*, periodontium; *B*, alveolar bone.

Fig. 5.—Hypertrophy and wave-like foldings of dentine. Agenesis, aplasia, and premature amelogenesis of enamel. Longitudinal section of a capped lower incisor, similar to the area shown in Fig. 4. Survival period of 143 days. *Pu*, Pulp; *Od*, odontoblasts, which are shorter than normally; *D*, folded dentine is about four to five times thicker than normally. At the areas *e* groups of short ameloblasts covering directly the bare dentine surface. *E*, Spaces formerly occupied by enamel produced in the form of thick enamel drops, but now lost in decalcification. Adjacent to them the ameloblastic layer is much narrower than that in Fig. 4. Between the enamel drops at point *x*, the remains of enamel matrix, indicating the disturbance of maturation.

The x-ray examination showed that the curvature of the teeth, in particular that of the upper incisors, was distorted. It was flatter than normally or consisted of two arches of two different segments. In the latter case, the anterior arch belonged to a smaller circle and represented the part of the tooth the development of which had been finished already before the placing of the caps.

Fig. 6.—Displacement of a tooth due to the covering of its crown with a metal cap. Cross section of the imbedded part of the lower incisor moved laterally in the direction of the arrow. Area at the occlusal level of the apical third. In the zone of pressure (*b*) the periodontal space is narrow, but in the zone of pull (*a*) it is about three to four times wider than normally. On the side of the pull richly developed osteoblasts cover the inner surface of the alveolus. Obliteration of the pulp. The outer surface of the dentine is of a wave-like appearance. Labially, the white space, adjacent to the dentine was formerly occupied by enamel now lost in decalcification.

The posterior arch was flatter and represented the portion which at the beginning of the experiment was still in the stage of development. In this area the contour of the tooth was wave- or accordion-like folded, and the microscopic examination showed a more or less pronounced displacement of Hertwig's sheath. In the anterior part, where the dentine is covered with an enamel layer formed and calcified before the experiment, no foldings were observed. An

exception is represented by some upper incisors, which, as mentioned previously, sometimes were broken. This means that the elimination of the hindrance to the eruption caused the shifting of the folded part of the tooth in the occlusal direction. In such cases the former folded basal part of the tooth now becomes the anterior part. Usually on the tops of the foldings the outer surface of the tooth shows resorptions of varied extent (Fig. 9).

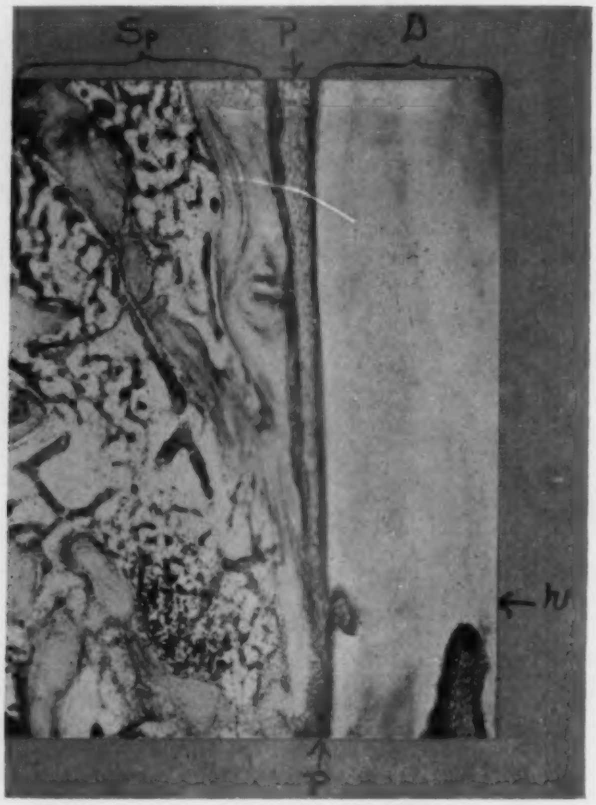


Fig. 7.—Bone and tooth changes on the side of pressure. Hyperemia in bone marrow. Narrowing of periodontal space (*P*); at *r*, deep resorption in the dentine (*D*); Sp, spongiosa of the alveolar bone. Cross section through the middle third of the incisor, 17 days after the cementing of caps.

In the formative portion of the tooth the dentine wall is about four to five times thicker than normally (Fig. 5). The extent of the pulp chamber is reduced, and its anterior half is usually obliterated (Fig. 6). However, the size of the pulp is considerably diminished; its histologic structure (Fig. 5) shows no significant deviation from the normal picture, except for a slight diminution in the vascularity. The odontoblasts appear shorter in shape, but their columnar arrangement is normal, and the cells are capable of producing regular dentine (Fig. 8). Enclosed in the depths of the folds, the odontoblasts degenerate and then disappear completely (Fig. 9).

The following changes of the enamel are present: in the anterior zone, which has been formed before the experiment, the enamel, as a whole, is ap-

parently normal in structure except for some resorptions of its outer surface.* Covering it, ameloblasts have lost their cylindric shape and are no more distinguishable from the adjacent connective tissue of periodontium.

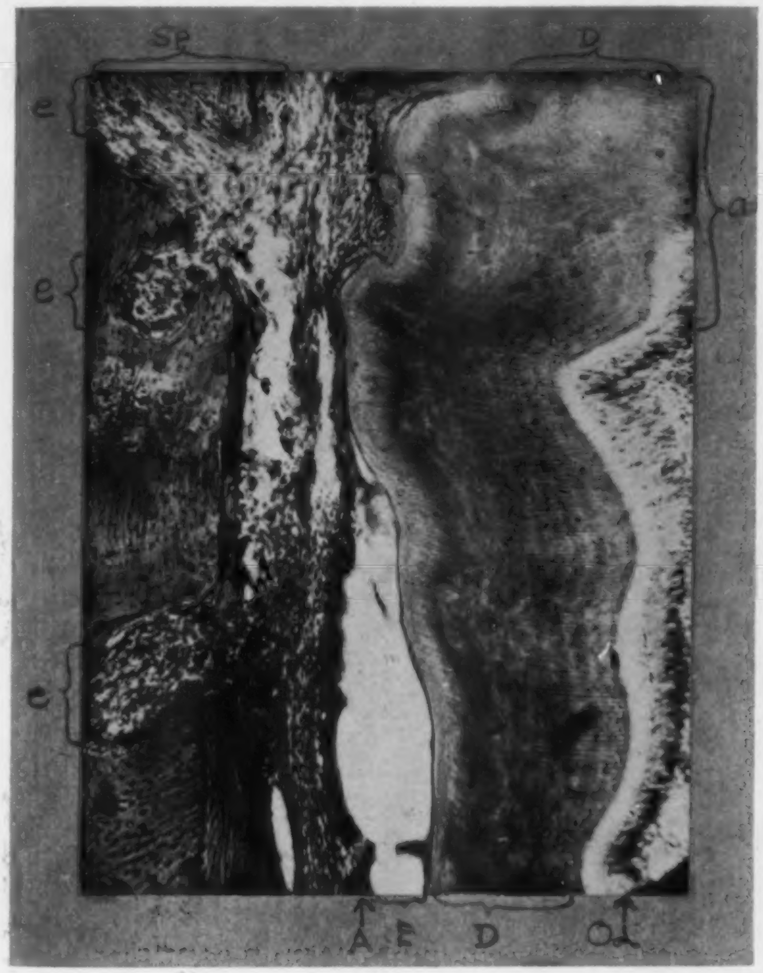


Fig. 8.—Undermining resorption of the inner wall of the alveolus on the side of pressure; aplasia and "premature amelogenesis" of enamel. Longitudinal section of the capped lower incisor. Apical third. At points *e*, the bony marrow spaces containing osteoclasts communicate along the line of resorption with the periodontium. In the area *a* there is ossification of the enamel cells. Below them the enamel (*E*) is developed in the form of thick bulk (enamel substance is lost in decalcification). *A*, Ameloblastic layer; *D*, wave-like formed dentine, well calcified and canalized, but considerably thicker than normally; *Od*, odontoblasts; *Sp*, inner wall of the alveolus with bony spaces.

In the basal region the characteristic appearance is the almost complete absence of enamel (Figs. 5, 8, and 9). It is only in some areas that enamel has developed, though hypoplastic or hypocalcified (Fig. 11). Ameloblasts are represented chiefly in the form of flattened spindle-shaped or disintegrated

*Since the ground sections were not performed, this statement is based on the result of roentgenographic examinations and that of decalcified sections which showed that in the space formerly occupied by the enamel, but now lost in decalcification, the remains of enamel matrix were not present.

cells covering directly the bare dentine surface (Figs. 5 and 11). In a few areas, especially between dentine foldings, the bare dentine is covered also by isolated groups of normally structured but short-shaped cuboid or columnar ameloblasts (Figs. 5 and 9). It is not rare that the enamel cells, especially on the cusps of the foldings, undergo ossification (Fig. 8). In the region of the apical third where normally the enamel matrix is still in development, between the foldings, the enamel is sometimes formed in the shape of large bulks (Figs. 5 and 8). These bulks are considerably thicker than the layer of enamel matrix in the corresponding zone of the normal tooth. Adjacent to them an ameloblastic layer might consist of cells which are essentially shorter than normally.

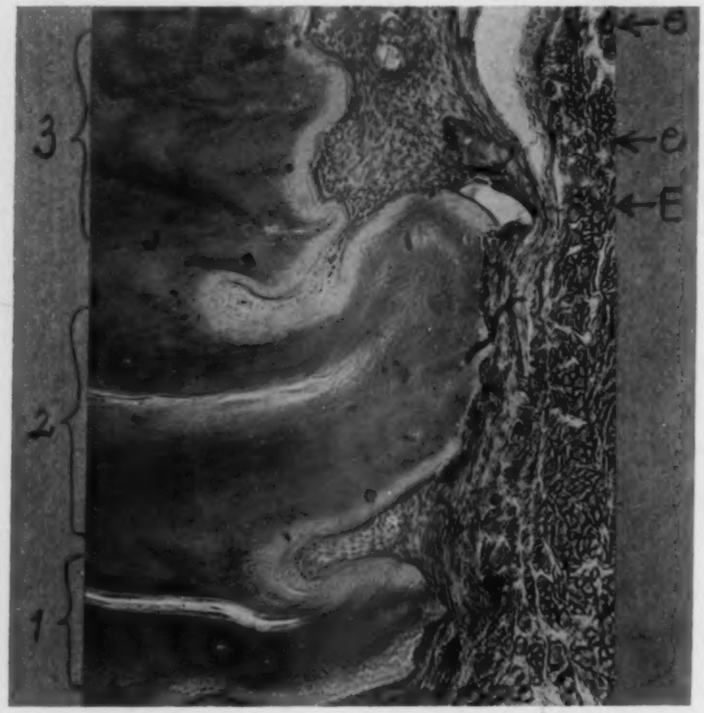


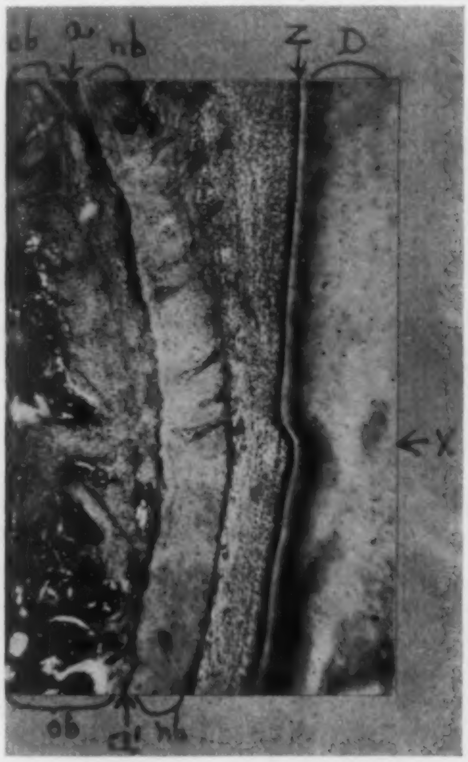
Fig. 9.—Surface-like resorption and accordion-like foldings of dentine. Aplasia and resorption of enamel. Side of pressure. Longitudinal section of a capped upper incisor the crown of which was broken twice during the experiment. Survival period; 103 days. Occlusal third of the intra-alveolar portion of the tooth. At the tops of the foldings *1* and *2* periodontic fibers pressed together (*P*), they are in close contact with the jagged surface of resorbing dentine. The outer surface of folding *3* is in some areas covered with the ameloblastic layer. Enamel (*E*) is seen only in the form of a little bulk which, like the dentine, undergoes resorption. On the level of the third top are two isolated isles of organic matter, enclosed in connective tissue.

In the connective tissue of the periodontium there can be observed isolated isles of enamel matrix material, in the form of globules (Fig. 9) of various size and irregular outline, which are without a cell-layer or are surrounded by flat and degenerated ameloblasts.

As to the changes in the paradental tissue, it should be noted that the cross section of the embedded part of the tooth shows its displacement in the lateral direction (Fig. 6). On the side of pressure the alveolar bone undergoes

osteoclastic resorption. First of all it is to be seen along the inner wall of the alveolus which is scalloped in outline. In the areas that have been subjected to a particularly severe occlusal pressure an undermining resorption, moreover, takes place (Fig. 8). In this case osteoclasts appear also in the inner walls of the marrow spaces which later communicate with the periodontal space. Bone marrow shows hyperemia (Fig. 7) and fibrous changes. The periodontal space is considerably narrowed (Figs. 6, 7, and 12), and the tissues of the periodontal membrane reveal the picture of compression (Figs. 7, 9, and 12). Fibers are

Occlusal



Apical

Fig. 10.

Occlusal

Apical

Fig. 11.

Fig. 10.—Transformation of the alveolar bone, due to the capping of the tooth. Upper incisor of a guinea pig with the survival period of 103 days. Longitudinal section. Area of the occlusal third. Side of traction. In the direction *a-a* a course of the former inner alveolar wall, now borderline between the old spongy bone (*ob*) and the new dense anchorage bone (*nb*).

Fig. 11.—Hypoplasia and hypocalcification of enamel on the side of pressure. Longitudinal section of capped lower incisor of guinea pig with a survival period of 103 days. Area of the middle third of the tooth. At region *a* the remaining enamel matrix indicates the disturbance in the maturation process of the enamel. At *r*, area of hypoplastic enamel; *P*, periodontium; *D*, dentine.

pressed together and their nuclei have become elongated. At points, where the tooth surface is forced into contact with the bone, injured connective tissue undergoes hyaline degeneration (Fig. 12). In these areas of severe compression the destruction of the tooth itself appears in the form of the resorption of its outer surface (Figs. 7 and 9). These resorptions occurred on the surface of the

tooth covered with either enamel or cement. The aforementioned destruction in the alveolar bone, the periodontium, and the tooth is more strongly pronounced at the top areas of the foldings (Fig. 9).

On the side of the pull the periodontal space is considerably widened (Fig. 6). On the inner surface of the alveolus the extraordinary traction causes a development of a new dense anchorage bone (Fig. 10). The reinforcement of the static structure of the jaws appears in the mighty formation of a new bone, also on the outer surface of the alveolar process (Fig. 12). This newly deposited bone consists of very compactly arranged Haversian systems and bony spaces. The formative activity of the osteoblastoma in the process of bone transformation is shown by richly presented cells and a somewhat brighter osteoid-seam of the newly developed bone.

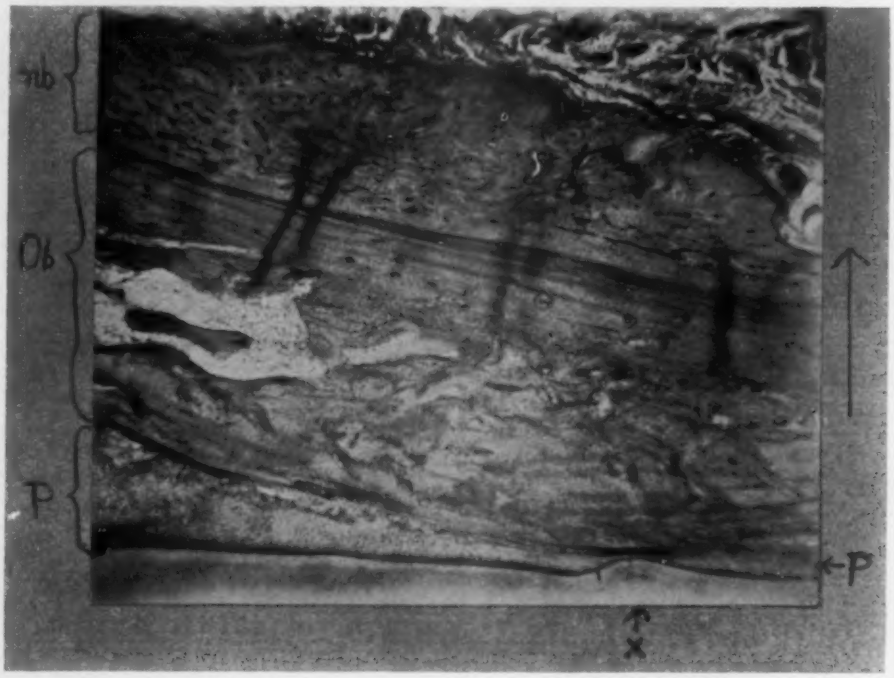


Fig. 12.—Transformation of the alveolar bone due to the capping of the crowns. Lower incisor of guinea pig with survival period of 50 days. Middle third of tooth. At *nb*, deposition of new bone consisting of very compactly arranged Haversian systems and bony spaces on the outer surface of the alveolar process. *Ob*, Old spongy bone. Notice the "hourglass" shape of the periodontal space—*P*. Hyaline degeneration of crushed periodontal fibers at point *x* of contact of the tooth with the bone. At the same point, owing to the bending of the tooth, its curvature forms two arches.

IV. DISCUSSION AND CONCLUSIONS

According to Boyle's[2] investigation, the incisors of guinea pigs are constructed in such a manner that the maximum of pressure produced by the force of mastication is distributed on the labial surface covered with enamel and affords the maximal attachment of periodontal fibers on the lingual surface covered with cement. Thus the periodontium of such a tooth is separated into the suspending and the cushioning parts. The periodontal space, hourglass in

shape, has a rotation point located in the proximal half of the embedded part of the tooth. In this way the force of mastication is absorbed and dissipated in the part of the periodontium nearest to the occlusal surface of the tooth, while the apical region, where a constant forming of enamel and dentine takes place, is protected from the action of the functional stress and pressure.

In our experiment the placing of metal caps upon the incisors results in an immediate retardation of the functional wear. As for the normal structure and function of continuously developing and erupting teeth of rodents, the harmony between the processes of functional attrition on one side and of eruption and growth of dental tissue on the other side is essential; the disturbance of one of these factors must forcibly be followed by the dissociation between the two others. Slowly though the wearing off of the caps prevents the eruption, the tooth growing in length tends to emerge from the alveolus. Since the rate of eruption is less severely disturbed than the rate of functional wear, considerable elongation of the crowns takes place. In connection with this elongation the axis of tooth rotation relocates more apically. Moreover, due to the coupling of the left and the right caps, both the change of the usual manner of excursion in the alveolus and the displacement of the tooth (embedded portion) in the lateral direction ensue.

The sequence of these pathologic changes in the dissipation of the masticatory forces appears, firstly, in a considerable increase of the functional demand upon the paradental tissue and, secondly, in the transmission of the masticatory force into the formative part of the tooth.

Changes in the Alveolar Bone.—The excess of the functional demand upon the supporting apparatus resulted both in destructive and reparative changes of the alveolar bone, which are similar to those reported by other investigators about teeth of dogs[7, 8, 14, 18, 21, 22, 23, 24] and monkeys,[4, 5, 10, 15, 16, 17, 26] experimentally overstressed by means of orthodontic appliance or capping. The severity of damage is shown by Sandstedt's phenomenon of undermining bone resorption on the side of pressure. Moreover, the squeezing and crushing of the periodontium and the resorption of the outer tooth surface indicate that the occlusal force provoked by means of capping caused changes which, according to Schwarz's classification, correspond to the fourth degree of the biologic effect. On the other hand, the reconstruction features of the alveolar bone reveal similar results to those obtained by Gottlieb and Orban in their experiment with metal crowns upon dogs, namely, the deposition of the new bone on both the inner and the outer surfaces of the alveolar process.

Dentine Findings.—In the anterior part, where the development of the organon dentale of rodents is already completed and functionally corresponds to the erupted tooth with limited development of other mammals, our findings consist of the previously described resorptions of the outer surface of the dentine.

But in the formative part of the incisor of our guinea pigs, foldings and the thickening of the dentine wall (Figs. 5, 6, 8, and 9) are characteristic features of overstress for the continuously growing and erupting teeth of rodents.

The other investigators observed similar changes in their experiments when dealing with the effect of the deficiency of hormones upon the teeth of rodents. Erdheim ascribed the folding of the tooth in parathyroidectomized rats to the flexibility of badly calcified dentine. But in hypophysectomized rats the foldings, as well as the considerable increase of thickness of the dentine, is explained by Schour and van Dyke with the disturbance of the growth of the alveolar bone, due to the almost complete stoppage of the skeletal growth, a consequence of hypophysectomy. Thus, the retarded growth of the alveolar bone, which normally aids the eruption, hinders it in this case. The consequence of all that is a disproportion between the rate of tooth growth in length and width and the rate of eruption, which results in an intense crowding and folding of the growing tooth especially at its basal zone. Also Becks, Collins, Simpson, and Evans[1] stated that various degrees of tooth folding observed by them in hypophysectomized rats were found to be an expression of delays in eruption.

The examination of dentine and bone tissue of untreated teeth, of molars, in our animals showed that the function of the odonto- and osteoblasts is not disturbed by any internal factor. It means that in the incisors the dentine changes depend exclusively on the dissociation between the processes of growth and that of eruption, due to the cementing of caps. With regard to dentine folding there is to be said that, notwithstanding the delays in eruption, the development of dentine tissue from the formative cells of dental papillae and, therefore, also the growth of dentine in length continue normally. Thus, more dentine is being grown up than worn down. Since the new-formed dentine is thin and without the support of enamel, it is easily flexible. The result is that the young dentine, retarded in eruption and prevented from moving forward, bends and pleats in foldings under the influence of the force of growth. In addition to this, the disproportion between the rate of the dentine growth in width and the rate of the shifting forward of these layers makes that the dentine substance does not remain constant anymore; it increases in amount because more dentine is being deposited than can be worn down.

One might expect that eventually such an accumulation of dentine, considering the delay in eruption, would lead to a total obliteration of the pulp chamber. But it did not occur even with the animals which lived longest, up to 143 days after the cementing of caps. The shortening of cells and the narrowing of the predentine show that this phenomenon is to be explained by the progressive slowing down of the dentine apposition, which stands in correlation with the gradually developed reduction of the formative activity of odontoblasts due to their dedifferentiation in the course of senile involution.

Since Virchow defined the increase in the actual size of individual tissue elements as hypertrophy, and in our experiment every endoplasm unit, i.e., dentine-forming cell, in a given region of the capped incisor produces more exoplasm and dentine than normally, this phenomenon is to be regarded as hypertrophy of the dentine tissue.

Our dentine findings, as described previously, may give an explanation for the changes observed by other investigators in their experiments, where the depressing of the developing tooth of dogs and monkeys has been performed in the course of orthodontic treatment. It is obvious that the stunting of the root with a subsequent shortening and thickening of the apical end, due to the intrusion of the tooth, as stated by them, is a feature of the hypertrophy of the dentine, provoked by the disturbed balance between the rate of root growth and that of dentine deposition.

Disturbance of the Enamel.—As the previous section shows, for our dentine findings such of them are characteristic that are determined by the disharmony between the dentine growth and the eruption of the tooth. Traumatic changes are not essential here because, being enclosed in the pulp chamber, the dentine-forming cells are almost completely protected from the influence of mechanical factors, with the exception of those that undergo pressure in the inner side of tooth foldings. Contrary to odontoblasts, the enamel-forming cells which cover the outer surface of the tooth could be subjected to a trauma along the whole length of the capped incisor owing to their unfavorable topographic position. Thus, in the teeth with caps the pathogenesis of enamel changes accounts for the pressure atrophy of ameloblasts, which is due to the compression of these cells during the folding and the displacement of the tooth, as well as to the transmission of the forces of mastication in the formative portion.

The feature of mechanical damage of the enamel has been described already by Erdheim, who stated that on the tops of dentine foldings in parathyroidectomized rats the ameloblasts undergo atrophy owing to the compression of the feeding blood vessels. According to Boyle's[3] research on scorbutic guinea pigs, the failure of the collagen fiber formation of the periodontium, due to the deficiency of ascorbic acid, allows the transmission of the excess of masticatory forces to the formative part of the tooth, thus causing a defective formation of the enamel. Similar traumatic injuries of ameloblasts, due to the apical transmission of masticatory forces, were observed by Kalninš and Ledina in guinea pigs with chronic scurvy, which were receiving large doses of para-thor-mone. Here the occurrence of such a transmission of these forces was ascribed to the apical relocation of the fulcrum of the tooth movement, accounted for by the severe destruction of the alveolar crest under the simultaneous influence of vitamin C deficiency and acute hyperparathyroidism.

The different appearance of the traumatic changes of the enamel in our experiment obviously depends both on the phase of formation in which enamel tissue was subjected to pressure and the degree of distortion of the ameloblasts. The compression of the Hertwig's sheath with the subsequent disturbance of developing ameloblasts caused a complete agenesis of the enamel organ. But the traumatic injuries of the already functioning ameloblasts resulted in the appearance of aplasia (Fig. 5), hypoplastic formation, or disturbed maturation of enamel matrix (Figs. 5 and 11). The intact ameloblasts covering the bare surface of dentine apparently represent previously damaged and then regenerated cells which after the recovery had not resumed their function of enamel formation (Fig. 9). But the enamel globules observed in the connective tissue probably are the product of detached ameloblasts (Fig. 9). In some areas where the pressure apparently was not so strong and the cells were not completely distorted, remaining to some extent capable of function throughout the normal time of their formative activity, fragments of the hypoplastic enamel were produced (Fig. 11).

In the case where the ameloblasts had been completely protected against trauma, bulks of enamel developed, sometimes in the form of large adherent drops (Figs. 5 and 8). The appearance of this calcified enamel in the basal part of the tooth, where normally the enamel matrix is still growing, indicates that such a developmental disturbance of the enamel, similar to that of the dentine tissue, depends on the disharmony between the rate of eruption and the rate of enamel formation. In the capped incisors the enamel matrix maturates within

the same time as this takes place in untreated teeth. There, owing to delayed eruption, the calcified enamel appears in the very apical part of the tooth and makes the impression of "premature amelogenesis." The greater thickness of the prematurely calcified enamel bulks at the first glance looks like an enamel accumulation. This feature is to be ascribed on one side to the fact that the growing of enamel matrix in width, due to the cessation of the eruption of the capped incisors, is accomplished already in the most apical region of the tooth where normally enamel matrix is still growing in width, and on the other side to the elevation and detachment of the ameloblastic layer, a consequence of the bending of the dentine wall. On the disproportion between the eruption and the development of enamel depends also the short shape of the ameloblasts that had escaped mechanical injuries in the posterior part of the tooth, and also the feature of complete degeneration and keratinization of the ameloblasts formed before the experiment in the anterior part of the tooth. This last phenomenon is to be explained with the final result of the advanced physiologic degeneration of senescent ameloblasts, which normally would have been migrating forward and then worn off, if the eruption had not been arrested.

SUMMARY

Changes in the dental organ by placing metal caps upon the continuously growing and erupting teeth of rodents were studied roentgenologically and microscopically in incisors of 8 adult guinea pigs.

1. The capping of the incisors caused a disproportion between the processes of physiologic attrition, eruption, and the growth of dental tissue, which ensued in the elongation of the crowns and the displacement of the tooth with a subsequently increased functional demand upon the paradental tissue, and the transmission of the masticatory force into the formative part of the tooth.

2. The transformation process of the jawbone and dental changes in the anterior portion of the tooth (part, formed prior to the experiment) are similar to those reported by other investigators with regard to the experimentally overstressed teeth of dogs and monkeys. Namely, the traumatic injuries of dental and paradental tissue correspond to the fourth degree of the biologic effect (according to Schwarz's classification), but the reparative changes consist in the deposition of the new bone on the inner and outer surfaces of the alveolar process.

3. In the basal portion of the incisor (formative part, developed during the experiment) the delays in eruption with a simultaneously continued normal growth of the dentine in width and length resulted firstly in hypertrophy and secondly in the folding of the dentine wall.

4. The enamel findings relate chiefly to the traumatic changes. The transmission of the masticatory force into the formative portion as well as the displacement of the tooth and the folding of the dentine wall resulted in the pressure atrophy of the enamel-forming cells. With regard to both the stage of development and the degree of distortion of the ameloblasts, the corresponding regressive changes, as agenesis of the enamel organ, aplasia, hypoplastic formation, as well as the hypocalcification of the enamel matrix and the development of the hypoplastic enamel, were stated.

5. The developmental disturbance of the enamel tissue, due to the disharmony between the process of eruption and that of the enamel formation, appears in the form of premature amelogenesis and the advanced physiologic degeneration of the senescent ameloblasts.

REFERENCES

1. Becks, H., Collins, D. A., Simpson, M. E., and Evans, H. M.: Changes in the Central Incisors of Hypophysectomized Female Rats After Different Postoperative Periods, Arch. Path. **41**: 457, 1946.
2. Boyle, P. E.: Tooth Suspension. A Comparative Study of the Paradental Tissues of Man and of the Guinea Pig, J. D. Res. **17**: 37, 1938.
3. Boyle, P. E.: The Effect of Ascorbic Acid Deficiency on Enamel Formation in the Teeth of Guinea Pigs, Am. J. Path. **14**: 843, 1938.
4. Breitner, C. D.: Bone Changes Resulting From Experimental Orthodontic Treatment, AM. J. ORTHODONTICS AND ORAL SURG. **26**: 521, 1940.
5. Breitner, C. D.: The Influence of Moving Deciduous Teeth on the Permanent Successors, Int. J. Orthodontia **26**: 1152, 1940.
6. Erdheim, J.: Ueber die Dentinverkalkung im Nagezahn bei der Epithelkörperchentransplantation, Frankfurt. Ztschr. f. Path. **7**: 265, 1911.
7. Gottlieb, B., and Orban, B.: Die Veränderungen der Gewebe bei übermässiger Beanspruchung der Zähne, Leipzig, 1931, Georg Thieme.
8. Gottlieb, B., Orban, B., and Kronfeld, R., cit. Kronfeld, R.: Histopathology of the Teeth and Their Surrounding Structures, Philadelphia, 1933, Lea & Febiger.
9. Gubler, W.: Gewebeveränderungen bei Verwendung activer orthodontischer Apparate, Schweiz., Monatschr. Zahnh. **51**: 387, 1941.
10. Johnson, A. L., Appleton, J. R., and Rittershofer, L. S.: Tissue Changes Involved in Tooth Movement, INT. J. ORTHODONTIA **12**: 889, 1926.
11. Kalniņš, V.: The Effect of Ascorbic Acid Upon the Teeth and the Jawbone of Scorbutic Guinea Pigs (Dissert. in Latvian), Riga, 1940.
12. Kalniņš, V.: Wirkung der Ascorbinsäure auf die Zähne und den Kieferknochen skorbutischer Meerschweinchen (preliminary report in German of the former work, No. 11), Upsala läkaref. förh. **45**: 117, 1939.
13. Kalniņš, V., and Ledina, H.: Die Wirkung des Epithelkörperchenhormons auf Zähne und Knochen normaler und skorbutischer Meerschweinchen, Upsala läkaref. förh. **52**: 1, 1947.
14. Kalvels, D.: Expansion of the Maxillary Dental Arch in Dogs by Means of the Transversal Screw (Dissert. in Latvian), Riga, 1939.
15. Marshall, J. A.: A Study of Bone and Teeth Changes Incident to Experimental Tooth Movement and Its Application to Orthodontic Practice, INT. J. ORTHODONTIA, **19**: 1, 1933.
16. Oppenheim, A.: Die Veränderungen der Gewebe, insbesondere des Knochens bei der Verschiebung der Zähne, Vrtljschr. f. Zahnh. **27**: 303, 1911.
17. Ota, M.: Ueber den Einfluss der orthodontischen Kräfte auf die noch nicht ausgebildeten Zähne, insbesondere auf die Zahnbildungszellen, Kokub. Zass. **11**: 240, 1937 (Japan) cit. Fujita, T. Zentralbl. Ges. Zhn. M. Kieferhlk. **4**: 119, 1931.
18. Sandstedt, C.: Einige Beiträge zur Theorie der Zahnregulierung, Nordisk Tandl. Tidskr. **5**: 236, 1904; **6**: 1, 141, 1905.
19. Schour, I., and van Dyke, H. B.: Changes in the Teeth Following Hypophysectomy. I. Changes in the Incisor of the White Rat, Am. J. Anat. **50**: 397, 1932.
20. Schour, I., and Massler, M.: The Teeth, From Griffith, J. Q., and Farris, E. J.: The Rat in Laboratory Investigation, Philadelphia, 1942. J. B. Lippincott Company.
21. Skillen, W. G., and Reitan: Tissue Changes Following Rotation of Teeth in the Dogs, Angle Orthodontist **10**: 140, 1940.
22. Stutewille, O. H.: Injuries to the Teeth and Supporting Structures Caused by Various Orthodontic Appliances, and Methods of Preventing These Injuries, J. Am. Dent. A. **24**: 1494, 1937.
23. Schwarz, A. M.: Gewebsveränderungen bei orthodontischen Massnamen, Fortschr. der Orth. **1**: 380, 1931.
24. Urban, L. B., Beisler, and Skillen, W. G.: Tissue Disturbance Caused by Mechanical Separation of the Teeth of the Dog, J. Am. Dent. A. **13**: 1943, 1931.
25. Westin, G.: Die skorbutischen Zahnveränderungen und ihre Beeinflussung durch synthetisch dargestellte C-Vitamin-Präparate, Ztschr. f. Vitaminforsch. **2**: 1, 1933.
26. Ziebe, H.: Die Bisserhöhung, Deutsche Monatschr. f. Zahnh. **51**: 49, 1933.

Department of Orthodontic Abstracts and Reviews

Edited by

Dr. J. A. Salzmann, New York City

All communications concerning further information about abstracted material and the acceptance of articles or books for consideration in this department should be addressed to Dr. J. A. Salzmann, 654 Madison Avenue, New York City

Congenital Malformations, A study of Parental Characteristics With Special Reference to the Reproductive Process: By Douglas P. Murphy, M.D., F.A.C.S., Assistant Professor of Obstetrics and Gynecology and Research Associate in the Gynecean Hospital Institute of Gynecologic Research, University of Pennsylvania. Second edition. 127 pages. Price, $5.00. Philadelphia, J. B. Lippincott Company, 1947.

This volume deals with the parental background from which defective children are likely to arise. It aims to explore causes of maldevelopment and to determine the chances that children born in families subsequent to the birth of a deformed child will suffer a similar fate. Part I of the present volume presents random samples of families that gave rise to congenitally malformed offspring. Part II deals with two groups of families in which the mothers had been exposed to therapeutic amounts of pelvic radium or roentgen irradiation during pregnancies which went to term. A chapter is presented on mothers who gave birth to malformed children and who had suffered from rubella (German measles) after their children were conceived.

The various factors observed point to the parental background which favors the production of congenital malformation in the offspring and thereby indicates the chances that any future children in such families may be found to be malformed at birth.

The term "congenital" has frequently been used to denote different states. As employed by Murphy, a congenital condition is one which is present at birth and has no other significance. The term "malformation" is used to denote any gross anatomical deviation from the normal and is employed interchangeably to indicate such terms as defect, anomaly, deformity, and abnormality. It would be well for orthodontists to follow the same terminology and thus do away with a multiplicity of terms which are frequently confusing.

Murphy found that approximately 47 individuals possessing congenital malformations were born alive or dead per 10,000 live births. In families already possessing a malformed child the birth rate of subsequent offspring was approximately 1,120 per 10,000 live births, which is approximately 24 times greater than the rate in the general population. Malformation occurred less frequently in earlier marriages than in later ones. It may surprise some to learn that the incidence of malformation among white people (57 per 10,000) was nearly twice that in the Negro race (32 per 10,000). Malformed offspring were born prematurely more than 4 times as often as their normally developed siblings, while later born children were found to be malformed more often than their earlier born siblings.

Birth of a malformed child was preceded by a period of relative sterility more often than the birth of a normally developed sibling.

The most obvious dietary deficiencies among mothers who conceived malformed children were a lack of calcium, phosphorus, iron, and vitamins B, C,

and D. One half of the mothers pregnant with malformed offspring exhibited signs of anemia.

Harelip and cleft palate were the most prevalent defects involving the musculoskeletal system. The cleft lip and cleft palate were more common on the left side than on the right. One father had a child with harelip and cleft palate by each of two wives, and in each instance the defect was on the same side, the right, which is the uncommon side for the abnormality to occur.

In families possessing two or more offspring the defect in the first-born malformed child was duplicated in the subsequently malformed siblings in nearly one half of the instances. In cases in which a distant relative exhibited the defect the malformation in the defective child showed a duplication in approximately one half of the instances. Of the 890 individuals who were studied, 25 per cent were stillborn and 90 per cent were either stillborn or died within a year of birth.

It would appear from the data presented by Murphy that parents of congenitally malformed children have a greater chance of having another malformed child than other couples and that the chance of having such a child is increased if one or both parents are well advanced in years. Syphilis, as shown by the Wassermann test of the blood, does affect the mothers of congenitally malformed offspring more often than those of children who are normally developed at birth.

The foregoing observations and conclusions were made by Murphy on mothers who were not subjected to heavy radium or roentgen irradiation of the pelvis during the pregnancies concerned nor did any of the mothers suffer from rubella when pregnant with the malformed offspring. Both maternal irradiation and rubella can play very definite roles in influencing fetal development. These are discussed in separate chapters.

With respect to heredity, evidence favoring heredity is to be found in the frequent duplication of defects in brothers and sisters. This was observed in the more serious malformation as well as in the more common type of less serious ones. Murphy concludes that congenital malformations, as they appear in a random sample of the population, arise from factors inherent in the germ cells prior to fertilization.

Pelvic irradiation during pregnancy was found to be injurious to the fetus in utero. Over 37 per cent of the children manifested mental or physical abnormalities attributable to irradiation. The large number of cases of microcephaly in children irradiated in utero when compared to the occurrence of this condition and the population at large suggests that maternal pelvic irradiation was the cause.

Murphy considers Gregg to be the first observer to call attention to maternal rubella during pregnancy as a possible cause of congenital malformations in the child. The importance of maternal infection with rubella is indicated not only by the great variety of the developmental disturbances in the offspring but also by the serious nature of these conditions. The most common dental defect is retardation at the time of eruption, hypoplasia, constricted arch formation, caries, and defective tooth forms. Malformed children have also been born to mothers suffering from infectious diseases other than rubella when pregnant. Thus, maternal measles and chicken pox are known to have been followed by defective offspring.

Murphy concludes that the incidence of developmental abnormality resulting from environmental factors acting after fertilization has taken place is extremely small in proportion to those which result from genetic causes. However, when considering the possible origin of any congenital malformation, it must

be remembered that defects may arise from environmental causes. The only environmental factors known at the present time to operate during pregnancy are therapeutic, maternal, pelvic irradiation, and rubella. Even in the presence of these conditions in the mother during pregnancy there still remains the possibility that her child's defects were of genetic origin. It is believed, at present, that rubella is not the only infectious disease of the expectant mother that can influence fetal development.

Clinical Dental Roentgenology, Technic and Interpretation Including Roentgen Studies of the Child and the Young Adult: By John Oppie McCall, D.D.S., F.A.C.D., Former Director, The Murry and Leonie Guggenheim Dental Clinic; Former Professor of Periodontia, New York University, College of Dentistry; Visiting Lecturer in Periodontia, New York University, College of Dentistry; Consultant to the Dental Service, New York Hospital; Associate in Public Health and Preventive Medicine, Cornell University, College of Medicine; Former Lieutenant Commander (Dental Corps) United States Naval Reserve, and Samuel Stanley Wald, D.D.S., F.A.C.D., Assistant Professor of Roentgenology, New York University, College of Dentistry; Lecturer in Dental Radiology, New York University, College of Medicine; Former Head of the Department of Diagnosis and Roentgenology, The Murry and Leonie Guggenheim Dental Clinic and School for Dental Hygienists; Special Lecturer in Roentgenology and Oral Diagnosis, United States Naval Dental School, National Naval Medical Center, Bethesda, Maryland; Consultant in Charge of Roentgenology and Oral Diagnosis, Dental Clinics of the Community Service Society of New York; Captain (Dental Corps), United States Naval Reserve. Second edition with 1,180 illustrations on 415 figures. Pp. 343 xvi. Price, $6.75. Philadelphia, W. B. Saunders Company, 1947.

In the present edition of the book, special emphasis has been placed on differential diagnosis, cysts, bone displacements, and tumors of the jaws. Possible effects on dentists and dental x-ray technicians of x-ray radiation are discussed, and criteria are provided by which the safety of the dentist and the patient may be assured.

In the chapter on head and film position in dental roentgenography, different figures are given for taking various views. In each case, illustrations are provided showing the position of the patient, the position of the cone of the x-ray tube, and the position of the film. A test for determining the radiation effect and the daily tolerance dose is given. Anatomical landmarks are explained, and differential diagnostic criteria are provided to differentiate pathologic conditions from normal landmarks.

In the chapter on the roentgenographic diagnosis of dental caries, the superiority of the bite-wing film is discussed and illustrated. At the same time, it is pointed out that the roentgenogram has its shortcomings in the diagnosis of dental caries when these are situated in the buccal or lingual surfaces. However, pit and fissure caries which may often be undetected by the explorer can frequently be discovered by roentgenographic examination. Criteria are presented for diagnosis of dental caries in children and the important role which the roentgenogram plays in this procedure.

The value of roentgenography in establishing a diagnosis in periodontal conditions is discussed, and new information is presented on the manifestation of periodontoclasia in children. Pocket formation in children is shown, and methods of detecting early stages of periodontal diseases by the aid of roentgenograms are provided. The practicing dentist and the orthodontist will find this book of great practical value in his everyday work.

The Stimulation of Growth, *J. A. M. A.*, Jan. 17, 1948.

To the Editor.—Is there any way of stimulating the growth of a boy of 12 who is normal except for being under average in stature?

George Gittell, M.D., New York.

Answer.—Almost all physicians interested in the fields of endocrinology and metabolism are in agreement that at the present time there is no commercially available pituitary growth hormone which is effective in promoting growth. Most persons who are below average height can put the blame for their condition on their genes rather than on their glands.

A 12-year-old boy may grow to a normal height at a later date, and it would seem inadvisable to attempt such procedures as administration of x-rays to his pituitary, the administration of testosterone propionate, or other measures. Use of thyroid is not contraindicated, provided it is administered under the observation of a physician.

Nail Biting, *J. A. M. A.*, Jan. 17, 1948.

To the Editor.—A boy aged 6½ years chews his nails. He is nervous, always on the go, very active and intelligent. Can he be trained to overcome the habit?

Arthur E. Perley, M.D., Waterloo, Iowa.

Answer.—Chewing nails is a puerile habit and may be associated with other habits of childhood such as thumb-sucking, masturbation, and finger-sucking, although less frequent than the others. It is seen in emotionally unstable and tense children who find some feeling of relief by chewing their nails. There is no danger in the habit. Most of the children quit it of their own accord when they start to meet others socially. Only a few continue to chew or bite their nails in adult life. There is no specific treatment. A rather kindly, pleasant, and understanding attitude with the giving of a reward if and when the chewing stops for a period of at least six months may work wonders. At least, this should be tried. One should not threaten or be exceedingly critical of this type of boy, because he will continue to do it.

News and Notes

American Association of Orthodontists
Forty-fifth Annual Meeting, May 2-6, 1949
Commodore Hotel, New York City

TENTATIVE PROGRAM

Sunday, May 1	
10:00 A.M.–9:00 P.M.	Registration.
2:00 P.M.	Meeting of Board of Directors.
Monday, May 2	
8:00 A.M.–9:00 P.M.	Registration.
9:00 A.M.	Guided sight-seeing boat trip around Manhattan Island.
1:00 P.M.	Bus to Campfire Club of America (men only).
2:30 P.M.	Campfire Club Outing—stag dinner and entertainment.
3:00 P.M.	"Get-acquainted" tea for ladies, with outstanding color motion pictures of bird life on Bonaventure Island.
8:00 P.M.	Radio City Music Hall Reservation (for ladies).
Tuesday, May 3	
9:00 A.M.–5:00 P.M.	Registration.
9:15 A.M.	Invocation. Walter T. McFall, Asheville, North Carolina.
	Address of Welcome. Walter H. Wright, New York City, Dean, New York University College of Dentistry.
	Response. Max E. Ernst, St. Paul, Minnesota, President-Elect, American Association of Orthodontists.
10:00 A.M.	President's Address. Lowrie J. Porter, New York City.
10:45 A.M.	Color Movie—Surgical Correction of Mandibular Deformities (Resection). Narrated by author. Reed O. Dingman, Ann Arbor, Michigan, Department of Oral Surgery, University of Michigan School of Dentistry.
11:15 A.M.	Paper—An Evaluation of the Tooth and Bone Structure in Patients Requiring a Reduction of Tooth Material in Treatment. Clarence W. Carey, Palo Alto, California.
12:00 NOON	Announcements.
12:15 P.M.–2:00 P.M.	International luncheon (Grand Ballroom).
12:30 P.M.	Ladies' luncheon and entertainment (East Ballroom).
2:15 P.M.	Paper—Criteria for Extraction in Orthodontic Therapy in Relation to Dentofacial Development. J. A. Salzmann, New York City.
3:00 P.M.	Color movie—Technique for Impression Taking and Model Pouring. Howard M. Lang, Los Angeles, California, Merton E. Hill, Jr., Laguna Beach, California, and John B. Wilson, Los Angeles, California. (To be narrated by Sidney E. Riesner, New York City.)
3:30 P.M.	Paper—Changing Dynamics of the Growing Face. Spencer R. Atkinson, Pasadena, California.
4:15 P.M.	Scientific exhibits supplementing Dr. Atkinson's paper. Spencer R. Atkinson, Pasadena, California. Assisted by: B. Edwin Erickson, Washington, D. C.; Frank W. Nash, Scranton, Pennsylvania; J. A. Salzmann, New York City; Samuel Fastlicht, Mexico City, Mexico; Robert L. Whitney, Pasadena, California; Fred G. Bowden, Denver, Colorado.

8:30 P.M.	Seats have been reserved for several popular plays. (Theater tickets to be selected through questionnaire sent with program.)
Wednesday, May 4	
9:00 A.M.–5:00 P.M.	Registration.
9:00 A.M.–2:00 P.M.	Guided tour of United Nations for the ladies. Lunch at United Nations.
9:15 A.M.	Paper—The Use of the Twin Wire Mechanism in the Treatment of Class II, Division 2 Malocclusion. Joseph E. Johnson, Louisville, Kentucky.
10:00 A.M.	Color movie—The Rehabilitation of the Cleft Palate Child. Lancaster Cleft Palate Clinic, narrated by Herbert K. Cooper, Director, Lancaster, Pennsylvania.
10:30 A.M.	Paper—The Clinical Importance of Facial Types. Wendell L. Wylie, San Francisco, California.
11:30 A.M.	Presentation of the Albert H. Ketcham Memorial Award by the American Board of Orthodontics.
12:15 P.M.	Past President's Luncheon.
	Luncheon and Annual Meeting of Northeastern Society of Orthodontists.
2:00 P.M.	Paper—Prophylactic Orthodontics (A. B. O. thesis). Faustin N. Weber, Memphis, Tennessee.
2:40 P.M.	Paper—A Summary of a Twenty-five-Year Record of Caries During Orthodontic Treatment (Tentative title).
3:00 P.M.	Movie—Cine-Fluoroscopic Study of the Movements of the Temporomandibular Joint. Sidney E. Riesner, New York City, and Robert Carlin, Johns Hopkins University, Baltimore, Md.
3:20 P.M.	Paper—Primary Dentition and Dentofacial Orthopedics (A. B. O. thesis). Dallas R. McCauley, Beverly Hills, California.
4:00 P.M.	Executive session.
6:30 P.M.	A Reception in honor of the President and Mrs. Porter. Given by the Northeastern Society of Orthodontists.
7:30 P.M.	Banquet, entertainment, and dance.
Thursday, May 5	
9:00 A.M.–5:00 P.M.	Registration.
9:00 A.M.–12:00 M.	Presentation of research papers.
	Presentation of the research award.
	Reading of the prize essay.
	(Program being arranged by the Research Committee.)
12:00 M.	Executive session.
	Installation of officers.
	Presentation of past president's key.
2:00 P.M.–5:30 P.M.	Registered Educational Clinics:
	1. Twin-Wire Mechanism.
	2. Edgewise mechanism.
	3. Labiolingual and Guide Plane.
	4. Use and Manipulation of the Headcap.
	5. Variations in orthodontic Technique (tentative title).
	6. Applied Cephalometrics in Clinical Orthodontics.
8:00 P.M.	Tour of Radio City and broadcasts (men and ladies).
Friday, May 6	
9:15 A.M.–12:30 P.M.	General table clinics and group clinics.

The following is a letter from the president of the American Association of Orthodontists:

THE AMERICAN ASSOCIATION OF ORTHODONTISTS
OFFICE OF THE PRESIDENT
1949 MEETING COMMODORE HOTEL, NEW YORK CITY MAY 2ND–6TH

February 1, 1949

TO ALL MEMBERS OF THE A. A. O.

My Dear Friends:

Another year has nearly passed since our last national convention. Many major issues have transpired since that time. The future of dentistry is now in the balance and your future and mine may be seriously affected by another year. It therefore seems most important that we all try our utmost to be present at our annual meeting in May.

Your committees are working hard to give you a most attractive meeting. The scientific program will be outstanding in practical "take home" value. The entertainment for both the men and ladies will be exceptional and different from the usual type of convention.

Monday, the first day of the convention, will be the outing day. Arrangements have been made to take the men, ladies and guests on a sightseeing guided boat trip around Manhattan Island, down the Hudson, past the Statue of Liberty, Ellis Island, the Battery, Wall Street district, Blackwell's Island, the Mayor's Mansion, through the Harlem river, etc., a sight of the New York skyline which can only be seen by boat.

At noon the ladies return to the Commodore for a fashion show, "get-acquainted" tea and a beautiful motion picture of the great bird breeding grounds on Bonaventure Island, the sanctuary of gannets, murres and several other species, a most thrilling sight and truly marvelous photography.

Buses will meet the men at the boat and take them to the Campfire Club of America, a wild, wooded section, 35 miles from New York. This club was founded by and belongs to "big game" hunters, among whom as our former President, Theodore Roosevelt; Daniel Beard, founder of the Boy Scouts of America; Ernest T. Seton, the great naturalist; William B. Greeley, famous leader of conservation and developer of national parks; the noted Colonel David Abercrombie and many other great outdoor men. Here will be professional demonstrations by experts in skeet and rifle and pistol shooting, fly casting, campfire building for speed records, blood hound tracking, etc., and finally, a stag dinner followed by movies and talks on big game hunting in Africa. Do not worry about a rainy day. In that case we have planned a great indoor program of exciting, startling movies by noted explorers, which can be seen only at such an outing. It will be a grand occasion for *all* members. (No plans have been made for golf.) We will all return to New York by bus in the evening.

We have prepared for some very special things for the ladies: a fashion show, a ladies luncheon, followed by an exceptional demonstration of flower arranging and use of decorative fabrics; a trip to the United Nations; President's reception, banquet and dance; theatre reservations, etc., and *plenty of time for shopping*. If *you* want this year to be *happy, do not let your lady miss these.* (Incidentally, if you want her to have a new mink coat, there are some wonderful fur shops on Fifth Avenue . . . but it will probably be best not to mention this!")

The scientific sessions will be interspersed with outstanding orthodontic educational movies. There will be papers on such subjects as the evaluation of tooth structure in extraction cases; clinical importance of facial types; primary dentition and dento-facial orthopedics; Changing Dynamics of the Growing Face; criteria for extraction in relation to dento-facial development; the use of twin arch in Class II cases and other practical papers on orthodontic treatment.

The problem of facial growth and the advisability of tooth removal seem to be matters of prime importance in orthodontic progress today. Your program committee has therefore attempted to have these subjects thoroughly covered at this meeting as well as giving you papers and demonstrations of technics which will be of great practical value to you.

The registered educational clinics will cover edgewise, labio-lingual-guide plane and twin arch demonstrations; the use and making of head caps and the use and importance of cephalometrics and photography in orthodontics.

One morning will be devoted entirely to outstanding papers on research which are important to orthodontics and the prize research essay will also be presented. On Friday morning, the general clinics, which have been carefully selected, will be of exceptional value.

Tuesday noon is the International luncheon, a most important feature which you *must* plan to attend. On Tuesday evening we have reserved about 500 seats for the theatre—100 seats for each of several of the most popular plays. You will have your choice by filling out the questionnaire which will come with your program.

Wednesday evening is the reception, banquet, entertainment and dance. You cannot miss this! The program is exceptionally attractive! (Dress optional.)

Thursday evening you will be on your own to do and go where you please. A tour of Radio City and broadcasts is being arranged for the men and ladies desiring it.

The Languild Convention Service (14 Washington Place East, New York 3, N. Y.) will be at your disposal. They can get theatre tickets or shop for you and will suggest places of interest to visit for both day or night entertainment.

In order that this meeting will not be over-crowded and prevent your being able to hear the papers and see the clinics, it was decided to limit the guest membership (see the AMERICAN JOURNAL OF ORTHODONTICS, November issue, page 963). The guest invitations have been limited because we want YOU there and we want you to get a lot out of the meeting so your trip will have been well worth while.

May is a fine time to visit New York. Why not spend two week-ends here?

Fill out the enclosed hotel reservation card at once! They are saving 500 rooms for us so we can all be together in the same hotel but your reservation should be made soon! Mention the A. A. O. if you write them!

A big welcome awaits you. Your committees are doing a grand job for you. Let's all be there!

Until then—my very best wishes.

LOWRIE J. PORTER,
41 East 57th Street,
New York 22, N. Y.

Prize Essay Contest, American Association of Orthodontists

Eligibility.—Any member of the American Association of Orthodontists; any person affiliated with a recognized institution in the field of dentistry as a teacher, researcher, undergraduate or graduate student shall be eligible to enter the competition.

Character of Essay.—Each essay submitted must represent an original investigation and contain some new significant material of value to the art or science of orthodontics.

Prize.—A cash prize of $500 is offered for the essay judged to be the winner. The committee, however, reserves the right to omit the award if in its judgment none of the entries is considered to be worthy. Honorable mention will be awarded to those authors taking second and third places. The first three papers will become the property of the American Association of Orthodontists and will be published. All other essays will be returned.

Specifications.—All essays must be typewritten on 8½ by 11 inch white paper, double spaced with 1 inch margins, and composed in good English. Three copies of each paper, complete with illustrations, bibliography, tables, charts, etc., must be submitted. The name and address of the author must not appear in the essay. For purposes of identification, the author's name together with a brief biographical sketch which sets forth his or her dental and/or orthodontic training, present activity, and status (practitioner, teacher, student, research worker, etc.) should be typed on a separate sheet of paper and enclosed in a sealed envelope. The envelope should carry the title of the essay.

Presentation.—The author of the winning essay will be invited to present it at the meeting of the American Association of Orthodontists to be held in New York City, New York, May 2-6, 1949.

Final Submission Date.—No essay will be considered for this competition unless received in triplicate by the Chairman of the Research Committee on or before March 15, 1949.

ALLAN G. BRODIE, Chairman Research Committee,
American Association of Orthodontists,
30 North Michigan Avenue, Chicago 2, Ill.

American Board of Orthodontics

The 1949 meeting of the American Board of Orthodontics will be held at the Commodore Hotel, New York, N. Y., April 28, 29, 30, and May 1. Orthodontists who may desire to be certified by the Board may obtain application blanks from the Secretary, Dr. Stephen C. Hopkins, 1726 Eye Street, N.W., Washington 6, D. C.

Northern Section of the Pacific Coast Society of Orthodontists

The members, wives, and guests met for cocktails and dinner on Sunday evening, Nov. 21, 1948, at the Tennis Club in Seattle. Emery Fraser presided and introduced Dr. W. B. Downs of Chicago, who was the guest clinician, Dr. Ernest Jones, Dean of the Dental School at the University of Washington, Dr. Harold Noyes, Dean of the Dental School at the University of Oregon, and Dr. Alton Moore of the Orthodontic Department at the University of Washington School of Dentistry.

Dr. Fraser called the scientific session to order Monday morning, Nov. 22, 1948, at the Washington Athletic Club in Seattle, Washington.

The following members were present: G. A. Barker, E. A. Bishop, L. Chapman, M. R. Chipman, H. F. Fraser, William Dinham, R. O. Gothenquist, S. B. Hoskin, P. D. Lewis, D. C. MacEwan, W. P. McGovern, P. T. Meany, H. N. Moore, H. Noyes, J. E. Richmond, H. G. Stoffel, A. E. Stoller, E. W. Tucker, J. T. Walls, C. H. Walrath, and E. S. Weyer.

The following guests were present: H. C. Dahl, R. DeButts, H. J. Hammond, R. E. Foster, T. L. Hice, G. T. Hill, J. Keenan, A. S. Maxon, G. R. McCulloch, G. Miller, R. C. Philbrick, D. Rees, K. M. Walley, J. M. Laughridge, A. Moore, and R. Crossley.

The death of Milton Fisher of Tacoma, Washington, was respectfully observed by a period of silence.

Dr. Fraser, Chairman, introduced the guest clinician, Dr. W. B. Downs of the Department of Orthodontics, College of Dentistry, University of Illinois.

The program was as follows:

1. The Dentofacial Complex (an analysis of the effect of skeletal and denture relationships on balance of the facial musculature.
2. Fundamentals of the Technique of Tracing Cephalometric Roentgenograms.
3. The Illinois Cephalometric Analysis.
4. The Technique of Analysis From Cephalometric Roentgenograms.
5. The Place of Cephalometry in the Analysis and Appraisal of Treatment Results.

The nominating committee submitted the following list of nominations which were unanimously accepted:

Chairman, William McGovern.
Secretary-Treasurer, E. A. Bishop.
Director, A. D. Stoller.

A. E. Stoller, Secretary.

Southern Section of the Pacific Coast Society of Orthodontists

The regular meeting was held at the Rodger-Young Auditorium, 935 West Washington Boulevard, Los Angeles, California, on Friday, Dec. 10, 1948.

The meeting was called to order at 2:30 P.M. by David England, who presented Herbert Muchnic, General Program Chairman, who in turn introduced Jack Taylor, Chairman for the day. The following program was presented:

Harvey Cole, recently from the University of Illinois, who uses and understands the cephalometer and its use in diagnosis, spoke on "Techniques in Cephalometry."

Robert Whitley, of Pasadena, California, presented some original work in a paper entitled, "Orientation of Orthodontic Models to the Frankfort Horizontal Plane and the Inferior Border of the Mandible."

Ernest Johnson, of San Francisco, gave a lecture, illustrated by slides, entitled, "The Appraisal of Profile Head Films and Their Evaluation in the Everyday Practice of Orthodontics."

The time from 5:30 to 7:30 was devoted to a social hour, after which each member present was given charts and equipment and Ernest gave detailed "Instructions in Completing a Downs and Wylie Analysis on Tracings of the Head Film," each member making his own chart.

The following officers were elected to serve for the ensuing year:

Sydney Cross, Chairman.
Herbert L. Shannon, Secretary-Treasurer.

Central Section of the Pacific Coast Society of Orthodontists

The regular meeting was held on Dec. 14, 1948, at the Alexander Hamilton Hotel in San Francisco. Ernest L. Johnson, Chairman, presided at both the afternoon and evening sessions.

Those present were:

Members: Murray Ballard, Reuben L. Blake, Leland Carter, J. Camp Dean, J. Kester Diment, Howard Dunn, Carl O. Engstrom, Seymore B. Gray, Fred E. Havrilla, Vernon Hunt, George Hahn, Ernest Johnson, Howard Jan, Earl Lussier, Ray Lussier, Jack McMath, B. E. Phillips, Lyle Russell, E. R. Schroeder, Will Sheffer, Carl Showalter, Art Skaife, William S. Smith, Glen Terwilliger, K. F. Terwilliger, W. F. Walsh, Fred West, Wendell Wylie.

Guests: Haig Albarian, Alan R. Cass, William Campbell, Arthur Corbett, Peter Ceremello, Harry Carlson, T. B. Engdahl, Glen Foor, Philip Konigsberg, Susan Locke, Thomas E. Lewis, R. B. Murray, William S. Parker, Jack Seaman, Harry Thompson, William E. Threlfell.

For the afternoon session, Program Chairman Ray Lussier presented Earl Lussier, who took for his topic, "The Critical Appraisal of Modern Orthodontics." He stated that a careful analysis of modern orthodontic papers reveals a confused and chaotic condition of the profession. He stressed the importance of a more systematic approach to record keeping, diagnosis, and therapy. Materials were presented as a table clinic to illustrate the value of each subject.

The meeting then recessed for dinner and was called to order again at 8:10 P.M. The minutes of the previous meeting were approved as published in the *Bulletin*. Membership applications of Ray Curtner, Harry Thompson, Harry Carlson, and Arthur Corbett were approved for presentation to the Board of Directors. The Chairman declared the Legislative Committee inactive.

Will Sheffer reported on the status of associate membership. The Chairman appointed a committee composed of Leland Carter, Art Skaife, and Seymore Gray to be in charge of an orthodontic program for the California State Dental Association meeting.

An election of officers for the following year resulted as follows:

Lyle D. Russell, Section Chairman.
Ray A. Lussier, Secretary-Treasurer.
Roy C. Cowden, Program Chairman.

Program Chairman Ray Lussier introduced J. Camp Dean who presented a paper entitled, "A Study of Expansion Through Orthodontic Stimulation." His discussion was illustrated with slides and models. After a résumé of orthodontic progress since the turn of the century and an appraisal of orthodontic appliances, he urged expansion and development as the aims of treatment. He declared that there is too much emphasis on the removal of teeth and that we should "nudge nature—not extract."

Harvey Cole, recently from the University of Illinois, who uses and understands the Cephalometer and its use in diagnosis, spoke on "Techniques in Cephalometry."

Robert Whitney, of Pasadena, California, presented some original work in a paper entitled, "Orientation of Orthodontic Models to the Frankfort Horizontal Plane and the Inferior Border of the Mandible."

Table clinics were given by the speakers to illustrate their work further.

Ernest Johnson of San Francisco gave a lecture, illustrated by slides, entitled, "The Appraisal of Profile Head Films and Their Evaluation in the Every Day Practice of Orthodontics."

General Meeting of the Pacific Coast Society of Orthodontists

At the twenty-first general meeting of the Pacific Coast Society of Orthodontists, the following program was presented:

Is the Genetic Pattern Irrevocable? J. P. Weinmann, Chicago, Illinois.

The Importance of Simplicity in Orthodontic Mechanism and Some Essential Requirements of Such Appliances. James David McCoy, Beverly Hills, California.

The Improved Universal Appliance—Its Application Based Upon Physiobiologic Factors. George Y. Nagamoto, Kansas City, Missouri.

Space Closure in Extraction Cases. Paul D. Lewis, Seattle, Washington.

Linear Arch Dimension and Tooth Size—An Evaluation of the Available Bone Structure for Accommodation of the Teeth. C. W. Carey, Palo Alto, California.

Histobiology of the Supporting Dental Tissues as a Basis for Appraisal of Orthodontic Risks. J. P. Weinmann, Chicago, Illinois.

The "Bow-Back" Operation for Relief of Prognathism. C. Herbert Walrath, Portland, Oregon.

Group Clinics by McCoy, Nagamoto, Lewis, and Carey.

The Cephalometer in Orthodontic Practice. Wendell L. Wylie, San Francisco, California.

A Professional Approach to Public Relations. James T. Walls, Portland, Oregon.

Southwestern Society of Orthodontists

The Twenty-eighth Annual Meeting of the Southwestern Society of Orthodontists will be held Sunday, Monday, Tuesday, and Wednesday, March 13, 14, 15, and 16, 1949, at the Texas Hotel, Fort Worth, Texas.

The program is as follows:

Dr. Lowrie J. Porter, President of the American Association of Orthodontists, New York, New York. Your American Association.

Dr. Harvey C. Pollock, St. Louis, Missouri. An Editor's Viewpoint on Present-Day Orthodontics.

Dr. Joseph D. Eby, New York, New York. Clinical Approach to Orthodontic Therapy.

Dr. Wendell L. Wylie, San Francisco, California. The Basic Architecture of the Human Face—Its Importance to the Orthodontist.

The Cincinnati Dental Society

The Cincinnati Dental Society takes pleasure in announcing that its March Clinic Meeting and Children's Dental Health Day will be held at the Netherland Plaza Hotel on March 20, 21, and 22, 1949.

Thomas P. Hinman Midwinter Clinic

The Thomas P. Hinman Midwinter Clinic will be held at the City Auditorium, Atlanta, Georgia, on March 20, 21, 22, and 23, 1949, under the auspices of the Fifth District Dental Society.

Oliver Testimonial

A testimonial party will be given for Dr. Oren A. Oliver of Nashville, Tennessee, on Saturday, March 12, 1949.

Denver Summer Seminar

The Twelfth Denver Summer Seminar for the advanced study of orthodontics will be held July 31 to Aug. 5, inclusive, 1949, at the Park Lane Hotel, Denver, Colorado. Dr. Howard Yost, Grand Island, Nebraska, is the new president of the Denver Summer Seminar, and Dr. E. S. Linderholm, Denver, Colorado, the new secretary. The complete program for the seminar will be announced early in 1949.

Sixth Annual Seminar for the Study and Practice of Dental Medicine

Plans are now under way for the Sixth Annual Seminar for the Study and Practice of Dental Medicine to be held Oct. 23-28, 1949, at the Desert Inn, Palm Springs, according to Dr. Hermann Becks, Seminar President.

Established six years ago under the direction of Dr. Becks, the Seminar is projected toward bringing together the medical profession for comparison and study of the latest findings of medical, dental, and biologic research men in their various activities, and is ultimately aimed at the prevention of disease.

Topics under discussion will include the implications of atomic energy in medicine and dentistry; recent developments in the metabolism of bones and teeth; physical growth and its relationship to teeth; various aspects of antibiotics and respiratory diseases; gingiva, and classification, systemic aspects, and histopathology of paradental diseases: the clinical diagnosis of dermatological lesions of the face and oral cavity; epidemiologic studies of dental caries with special emphasis on fluoride relationship to the problem; a lively discussion on personality traits.

Seven outstanding men of dental medicine and related fields will present these discussions. They are: Arthur C. Curtis, M.D., Professor and Director of the Department of Dermatology and Syphilology at the University of Michigan; Wilton Marion Krogman, Ph.B., M.A., Ph.D., Professor of Physical Anthropology, University of Pennsylvania; Seymour M. Farber, M.D., Assistant Clinical Professor of Medicine, University of California Medical School; Balint Orban, M.D., D.D.S., Professor at the University of Illinois; D. Harold Copp, M.D., who is collaborating with the Division of Dental Medicine at the University of California; Francis A. Arnold, Jr., B.S., D.D.S., Senior Dental Surgeon, U.S.P.H.S.; Paul Popenoe, Sc.D., Director of the American Institute of Family Relations in Los Angeles.

Detailed information concerning attendance at the Seminar may be obtained from Marion G. Lewis, Executive Secretary, 1618 Ninth Avenue, San Francisco 22, California.

Washington University School of Dentistry Postgraduate Course for Orthodontists

A comprehensive two-week course in labiolingual technique was held at Washington University School of Dentistry Jan. 17 to 29, 1949.

The class was attended by twenty-two orthodontists from fifteen states. It is interesting to note that six of the students were the sons of orthodontists.

The entire course was under the direction of Oren A. Oliver, D.D.S., Nashville, Tennessee, and Russell E. Irish, B.S., M.A., D.D.S., Pittsburgh, Pennsylvania. They were assisted by Boyd W. Tarpley, B.A., D.D.S., Birmingham, Alabama, and Harold K. Terry, B.A., D.M.D., Miami, Florida.

Lectures on fundamental problems in the field of orthodontics, as well as laboratory instruction in the construction of appliances, were conducted. Special attention was directed to the application as well as fabrication of the occlusal guide plane for use in the treatment of distoclusions and decreased vertical dimension. Detailed step construction of this important mode of treatment in its relation to the lingual appliance was presented by means of illustrated lectures and discussion of periodical reprints on the subject.

Supplementing the technical aspect, the following scientific subjects were presented:

Embryology. L. R. Boling, Ph.D., Professor of Anatomy, School of Dentistry.

Behavior Problems. Samuel R. Warson, M.D., Assistant Professor of Psychiatry, School of Medicine.

Radiodontics. C. O. Simpson, D.D.S., M.D., Professor of Radiodontics, School of Dentistry.

Endocrinology and Growth and Development. M. J. Carson, M.D., Assistant Professor of Pediatrics, School of Medicine, and W. G. Klingberg, M.D., Assistant in Pediatrics, School of Medicine.

Genetics. Harrison D. Stalker, Ph.D., Assistant Professor of Zoology, Washington University.

Postsurgical Rehabilitation. L. W. O'Brien, D.D.S., Assistant Professor of Clinical Dental Prosthetics, School of Dentistry.

Relation of Nose and Throat to the Oral Cavity. G. Neal Proud, M.D., Instructor in Clinical Otolaryngology, School of Medicine.

Anatomy of the Head and Neck. L. R. Boling, Ph.D., Professor of Anatomy, School of Dentistry.

Importance of Facial Form. Caroline Risque (Sculptor).

Ear Syndromes and Temporomandibular Relations. James B. Costen, M.D., Assistant Professor of Clinical Otolaryngology, School of Medicine.

Cleft Palate Problems. J. Barrett Brown, M.D., Professor of Maxillofacial Surgery, School of Dentistry.

Dental Materials. E. E. Shepard, D.D.S., Associate Professor of Clinical Dental Materials and Clinical Orthodontics, School of Dentistry.

Dentistry for Children—Preventive Orthodontics. Ruth E. Martin, D.D.S., Professor of Dental Pediatrics, School of Dentistry.

Some Thoughts on Aesthetics. Edmund H. Wuerpel, D.F.A., Dean Emeritus, Washington University School of Fine Arts.

The Third Molar. R. B. Rode, D.D.S., Professor of Clinical Oral Surgery, School of dentistry.

Oral Pathology. B. M. Levy, D.D.S, MS, Associate Professor of Oral Pathology, School of Dentistry

Speech Correction. Mildred A. McGinnis, M.A., Head of Speech Department, Central Institute for the Deaf.

Surgical Correction of Mandibular Prognathism. L. W. Peterson, D.D.S., Associate Professor of Oral Surgery, School of Dentistry.

Organizing Community Support for the Army and Air Force Professional Personnel Procurement Program

The Recruiting Station commander will ask the chairman of his Military Manpower Committee to initiate the program by calling a special meeting to consider it as a long-term community project. To insure synchronization with other aspects of the program, this should be done immediately upon receipt of this material.

In a community where an Army Advisory Committee exists, the Military Manpower Committee chairman should first contact the chairman of such Army Advisory Committee and invite representatives of the Committee to attend the meeting to consult on development of the program on a community-wide basis.

The president of the County Medical Society and the president of the local Dental Association should also be invited to attend the initial meeting. Following a thorough discussion of the problems, these professional representatives should be asked to submit the names of several local physicians, surgeons, and dentists for consideration as cochairmen of subcommittees to be called the Professional Manpower Committee.

The Military Manpower Committee will then select the cochairmen of this subcommittee. The Medical Society and Manpower Committee leaders will then call on the

physician and dentist selected, to explain the program and ask them to serve on the Manpower Committee and head the Professional Manpower Committee.

Membership of the Professional Manpower Committee should be restricted to eight or ten persons, each of whom should be prominent locally in one of the following professions or specialist fields:

Medicine	**Psychology**
Dentistry	**Psychiatry**
Nursing	**Nutrition**
Pharmacy	**Industrial hygiene**
Optometry	**Physical therapy**
Veterinary medicine	**Occupational therapy**
Bacteriology	**Dietetics**
Biochemistry	**Sanitary engineering**

If professional societies representing any of these fields are active in the community, the presidents of these societies should be consulted in the selection of professional representatives. The national organizations associated with several of these professions have been consulted in the development of this program.

In the absence of active professional societies, the chairman of the Manpower Committee and the Professional Manpower Committee may select professional representatives.

At the organizational meeting of the Professional Manpower Committee the cochairman should describe the plans for the local program, tell the professional representatives about the organization and operations of the Manpower Committee, and obtain agreement of his committeemen on a regular schedule of meetings.

The first project to be undertaken by the Professional Manpower Committee could be a survey to determine the community's resources in terms of this program, and the number of people in each profession who might be considered prospective volunteers for military service. Each professional society or association should be asked to cooperate in surveying the profession it represents. In the case of quotas which some national professional groups may have adopted, these quotas can be projected against the community's resources.

A kit containing a guidebook, with suggestions for carrying on this Professional Personnel Procurement Program will soon be distributed through Recruiting Stations.

Notice

The American Journal of Orthodontics solicits information in regard to the death or retirement of specialists in orthodontics. This is the only available means the Journal has of securing records of the workers in the specialty.—*Editor.*

Notes of Interest

Harry V. Banks, D.D.S., B.A., announces the association of Thomas A. Gardner, D.D.S., B.A., formerly of Omaha, Nebraska, in the exclusive practice of orthodontics at 1550 Lincoln Street, Denver, Colorado, phone KE. 8992.

Harry Wormington, D.D.S., M.S.D., announces that his practice is limited to orthodontics at the Professional Building, 722 Penn Avenue, Wilkinsburg, Pittsburgh 21, Pennsylvania, phone Churchill 2597.

Dr. Leon D. Bryant wishes to announce that Dr. Henry B. Richardson is associated with him in the practice of orthodontics at 815 University Building, Syracuse, New York.

OFFICERS OF ORTHODONTIC SOCIETIES

The AMERICAN JOURNAL OF ORTHODONTICS is the official publication of the American Association of Orthodontists and the following component societies. The editorial board of the AMERICAN JOURNAL OF ORTHODONTICS is composed of a representative of each one of the component societies of the American Association of Orthodontists.

American Association of Orthodontists

President, Lowrie J. Porter - - - - - - - - - - 41 E. 57th Street, New York, N. Y.
President-Elect, Max E. Ernst - - - - 1250 Lowry Medical Arts Bldg., St. Paul, Minn.
Vice-President, William R. Humphrey - - - - - - - 1232 Republic Bldg., Denver, Colo.
Secretary-Treasurer, George R. Moore - - - - - - 919 Oakland Ave., Ann Arbor, Mich

Central Section of the American Association of Orthodontists

President, Joseph H. Williams - - - - - - - - 3720 Washington Blvd., St. Louis, Mo.
Secretary-Treasurer, Earl E. Shepard - - - - - - - - - - 4500 Olive St., St. Louis, Mo

Great Lakes Society of Orthodontists

President, Wilson R. Flint - - - - - - - - - - - - Jenkins Arcade, Pittsburgh, Pa.
Secretary-Treasurer, Scott T. Holmes, 509 Hackley Union National Bank Bldg., Muskegon, Mich.

Northeastern Society of Orthodontists

President, Norman L. Hillyer - - - - - - - - - Professional Bldg., Hempstead, N. Y.
Secretary-Treasurer, Oscar Jacobson - - - - - - - - - 35 W. 81st St., New York, N. Y.

Pacific Coast Society of Orthodontists

President, S. B. Hoskins - - - - - - - - - - - Medical Dental Bldg., Portland, Ore.
Secretary-Treasurer, Frederick T. West - - - - - - 870 Market St., San Francisco, Calif.

Rocky Mountain Society of Orthodontists

President, Harry V. Banks - - - - - - - - - - - - 1550 Lincoln St., Denver, Colo.
Vice-President, Elmer S. Linderholm - - - - - - - - - 1558 Humboldt St., Denver, Colo.
Secretary-Treasurer, Ernest T. Klein - - - - - - - 632 Republic Bldg., Denver, Colo.

Southern Society of Orthodontists

President, Samuel D. Gore - - - - - - - - Maison Blanche Bldg., New Orleans, La.
Secretary-Treasurer, Frank P. Bowyer - - - - - - Medical Arts Bldg., Knoxville, Tenn.

Southwestern Society of Orthodontists

President, J. C. Williams - - - - - - - - - - Medical Arts Bldg., Fort Worth, Texas
Secretary-Treasurer, Marion A. Flesher - - - - Medical Arts Bldg., Oklahoma City, Okla.

American Board of Orthodontics

President, Bernard G. deVries - - - - - - - - - Medical Arts Bldg., Minneapolis, Minn.
Vice-President, Joseph D. Eby - - - - - - - - - - - - 121 E. 60th St., New York, N. Y.
Secretary, Stephen C. Hopkins - - - - - - - - 1726 Eye St., N. W., Washington, D. C.
Treasurer, James A. Burrill - - - - - - - - - - - - 25 E. Washington St., Chicago, Ill.
James D. McCoy - - - - - - - - 405 North Bedford Drive, Beverly Hills, Calif.
Reuben E. Olson - - - - - - - - - - - - - 712 Bitting Bldg., Wichita, Kan.
Raymond L. Webster - - - - - - - - - 133 Waterman St., Providence, R. I.

There is an apparent discrepan

The pages are either missing o

The filming is recorded as the

ancy at this point.

or the pagination is incorrect.

e book is found in the collections.

AMERICAN JOURNAL OF ORTHODONTICS

Published by THE C. V. MOSBY COMPANY, 3207 Washington Blvd.
St. Louis 3, U. S. A.

Entered at the Post Office at St. Louis, Mo., as Second Class Matter.

Published Monthly. Subscriptions may begin at any time.

Official Publication of The American Association of Orthodontists, its components societies and The American Board of Orthodontics

EDITORIAL COMMUNICATIONS

Original Communications.—Manuscripts for publication and correspondence relating to them should be sent to Dr. H. C. Pollock, 8015 Maryland Ave., St. Louis 5, Mo., U. S. A.

Manuscripts should be typewritten on one side of the paper only, with double spacing and liberal margins. References should be placed at the end of the article and should include, in the order given, name of author, title, journal, volume, pages, and year; e.g., Smith, E. J.: Children's Dentistry, Am. J. Orthodontics, 34: 1-25, 1947. Illustrations accompanying manuscripts should be numbered, provided with suitable legends, and marked on margin or back with author's name. Articles accepted for publication are subject to editorial revision. Neither the editors nor the publishers accept responsibility for the views and statements of authors as published in their "Original Communications."

Illustrations.—A reasonable number of half-tone illustrations will be reproduced free of cost to the author, but special arrangements must be made with the editor for color plates, elaborate tables, or extra illustrations. Copy for zinc cuts (such as pen drawings and charts) should be drawn and lettered only in India ink, or black typewriter ribbon (when the typewriter is used), as ordinary blue ink or colors will not reproduce. Only good photographic prints or drawings should be supplied for half-tone work.

Books for Review.—Only such books as are considered of interest and value to subscribers will be reviewed, and no published acknowledgment of books received will be made. These should be sent to Dr. J. A. Salzmann, 654 Madison Ave., New York City.

Reprints.—Reprints of articles published among "Original Communications" must be ordered specifically, in separate communication to the publishers, The C. V. Mosby Company, 3207 Washington Blvd., St. Louis 3, Mo., U. S. A., who will send their schedule of prices. Individual reprints of an article must be obtained through the author.

BUSINESS COMMUNICATIONS

Business Communications.—All communications in regard to advertising, subscriptions, change of address, etc., should be addressed to the publishers, The C. V. Mosby Company, 3207 Washington Blvd., St. Louis 3, Mo.

Subscription Rates.—Single copies, $1.00. In the United States and other countries of the U. S. Postal Zone $10.00 per year in advance. In Canada and other foreign countries $11.00.

Remittances.—Remittances for subscriptions should be made by check, draft, post-office or express money order, payable to the publishers, The C. V. Mosby Company.

Change of Address.—The publishers should be advised of change of subscriber's address about fifteen days before the date of issue, with both new and old addresses given.

Advertisements.—Only articles of known scientific value will be given space. Forms close first of month preceding date of issue. Advertising rates and page sizes on application.

Foreign Depots.—**Great Britain**—Henry Kimpton, 26 Bloomsbury Way, London, W. C. 1; **Australia**—Stirling & Co., 317 Collins Street, Modern Chambers, Melbourne.

Nonreceipt of Copies.—Complaints for nonreceipt of copies or requests for extra numbers must be received on or before the fifteenth of the month following publication; otherwise the supply may be exhausted.